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*King, J. Cash, and Cocke, Edwin W.: Therapeutic Fever Produced by Diathermy, with Special Reference to its Application in the Treatment of Paresis. South. Med. Jour., Mar., 1930.

See also Illinois M. J., LVI:3:203, Sept., 1929, "Artificial Fever Produced by High Frequency Currents—Preliminary Report." By Clarence A. Neyman, A.B., M.D., and S. L. Osborne, B.B.E.

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UTERINE CERVICAL CANCER: RADIUM VERSUS SURGERY *

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Statistics reveal that one woman out of every eight develops cancer and that carcinoma of the uterus is the most frequent malignant tumor found, constituting about one-third of all cases of cancer. About 90 per cent of all uterine cancers originate in the cervix, and carcinoma of the cervix is, therefore, the most frequent malignant tumor encountered in gynecologic practice.

With these facts before us it can readily be seen that the control of uterine cancer is one of our biggest problems. It behooves us as medical men, therefore, to give careful consideration to any method that will reduce the mortality from this most dreaded scourge of womankind.

About 97 per cent of cervical carcinomas occur in women who have borne children. The usual precancerous lesion is a chronic endocervicitis. Time does not permit a discussion of the symptomatology, diagnosis, etc., of cervical cancer; but once the diagnosis is established no time should be lost in seeking the proper treatment. This disease usually runs a rapid course, speedily invading the neighboring parts by direct extension and metastases, and is frequently recognized too late for other than palliative treatment.

Time and experience have demonstrated conclusively that of all the various therapeutic procedures advocated for treating cervical cancer, only two are generally recognized today: *surgery* and *radium.*

The Surgical Treatment

Surgeons and gynecologists are practically agreed that if surgery is to be used to eradicate cervical cancer, it should be used only in the early stages of the disease; that the operation must be radical, and the so-called radical abdominal hysterectomy of Wertheim the method of choice.

Unfortunately, the Wertheim operation of complete hysterectomy is a difficult operation to perform successfully, and carries with it a high primary operative mortality of from 5 to 42 per cent—10 to 15 per cent in the most skilled hands and 20 to 30 per cent in the hands of the average surgeon. Wertheim, himself, had a 30 per cent operative mortality in his first one hundred cases.

Before further consideration is devoted to a discussion of the surgical treatment it is well that the disease be classified in order to provide some convenient means of evaluating the treatment. A classification that has proven popular in this country is the one proposed by Schmitz (Professor of Gynecology, Loyola University), which is based on the local physical findings. The carcinomata are divided into primary and secondary or recurrent. The factors which determine the grading of the primary carcinomata are as given in the following grouping: *Group 1* comprises the earliest lesions which, unfortunately, are the least frequently seen. The growth is the size of a navy bean, is clearly localized within the cervix, and the uterus has normal movability (a uterus normally movable can be displaced downward without causing distress to the patient by the use of an unusual amount of force, or until the cervix appears at the vaginal outlet when pulled by a tenaculum forceps attached to the cervix). This group is sometimes called "operable." *Group 2* includes cases in which there is a wide or peripheral invasion of the cervix or body of the uterus, a doughy consistency of the paracervical tissues, and decreased mobility (evidenced by failure of the uterus to be completely displaced downward when pulled by a tenaculum forceps). This group is often called "doubtfully localized" or "borderline". *Group 3* includes cases in which there is infiltration of one or both parametria, with or without regional lymph node involvement or invasion of adjacent organs, but the structures are, as a mass, still movable, though elasticity of the tissues is lost. This group is sometimes called "advanced" or "inoperable" and is the condition most commonly present when the patient presents herself for radiation treatment. *Group 4* cases are characterized by absolute fixation of the tissue (the "frozen

* Read before the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, Mo., September 8, 1930.

pelvis"), wide local extent of the disease, and usually distant metastases. This group is often called "terminal", "fixed", "far advanced" or "inoperable." The "complicated" carcinoma is one associated with general disease that is considered a poor surgical risk.

The characteristics of the groups in the recurrent carcinoma (sometimes called Group 5) are: *Group R No. 1* contains the local but normally movable recurrence; *Group R No. 2*, the regional but movable recurrence; *Group R No. 3*, the cases with local and regional movable recurrences, and *Group R No. 4*, the recurrence, with fixation of the mass.

Schmitz in discussing his 332 cases of cervical cancer, classified them at the beginning of treatment as follows: Group 1, 7%; Group 2, 14%; Group 3, 49%; Group 4, 30%. Schreiner offered the following statistics in his series of 293 cases: Group 1, 5%; Group 2, 10%; Group 3, 26%; Group 4, 47%; Group 5, (Recurrent), 12%. Regaud classified his observations in his series of 678 cases in the following manner: Group 1, 12%; Group 2, 28%; Group 3 and 4, 60%.

It is quite obvious from the above data that *early* cervical carcinoma is infrequently seen. Practically all agree that Group 1 carcinoma can be adequately treated either by surgery or radium. Group 2 are the borderline type and an increasing number of surgeons show preference for radiation methods to that of surgery. Practically all agree that Group 3 and 4, and the recurrent group, are definitely inoperable.

The Wertheim Operation

The difficulties of the Wertheim operation for cervical malignancy are best described by those who have performed it on many occasions. We quote the following from Clark and Norris (Professors of Gynecology, University of Pennsylvania):

"We believe that many operations called radical fall short of the best teaching regarding this operation and that relatively few surgeons are capable of performing a satisfactory Wertheim operation. Even in really capable hands, the Wertheim operation, utilizing only selected cases, is a formidable operation and associated with a high operative mortality and a high proportion of morbidity as instanced by injury to the ureter, bladder and other vital structures. The radical operation requires extensive dissection, produces much trauma, results in a wide exposure of cellular tissues and opens avenues for infection and peritonitis. It is well known that virulent streptococci are frequently present in these cases.

"The possibilities of trauma, metastasis or implantation growths must also be borne in mind, as well as the effects of prolonged anesthesia, loss of blood, hemorrhage and shock, and other factors contributing to a high operative mortality. Hospitalization is often prolonged and in the most favorable cases two or three times that required for irradiation.

"The general trend of American surgeons is away from the Wertheim type of operation. This is based not so much on its high mortality and morbidity as upon the study of the end-results, which show that when the disease has extended beyond the cervix and when metastasis has developed, the five-year salvage is extremely small and does not overbalance the disadvantages of the radical procedure. On the other hand, if the cancer is confined to the cervix the same proportion of cure can be secured by less hazardous procedure.

"The radical abdominal hysterectomy for cancer of the cervix was suggested by Reis and Clark, and was later popularized by Wertheim through his extensive application of the principle and the perfection of its surgical detail. Clark's personal interest in this operation was engendered through the decided improvement in results following the application of the radical removal of the breast and its attending axillary dissection as suggested by Halsted. Clark championed the radical operation and as time ultimately proved, the final statistics from the clinics of this country and Europe, following its adoption, were the best hitherto published, but the primary mortality was high in all hands and shocking in many. Furthermore, the relatively low percentage of operability cut deeply into the actual proportion ultimately saved.

"It is recognized that no further progress is possible from still more radical surgical procedures for the utmost anatomic results have been reached. The radical abdominal operation has been thoroughly tried and at best the end-results are far from satisfactory. From the anatomic standpoint radical operation is hedged about with difficulties. The cervix is closely surrounded by vital structures, ureter, bladder and rectum, none of which can be sacrificed and injury to any of which is disas-

trous. The longer hospitalization and prolonged convalescence are also factors to be considered. Were it possible to show, however, that the radical operation actually offered better end-results, this naturally should outweigh all other considerations.

"It would seem generally accepted that irradiation is the preferable form of treatment for all but the very early cases and by it a greater percentage can be carried to the five-year period and in the remainder, life is usually prolonged and made more bearable.

"It is among the stage 1 cases that advocates of surgery still advise operation. The radical operation gives about the same end-results in the small group of early cases. Von Franque, 80% surgery; Von Scuffert, 90% irradiation, to quote the most favorable. The average operator, however, cannot hope to secure these results, and his results, even in the earliest cases are probably no better, if as good, as those secured by irradiation. Polak states that in New York 20% of cases are seen in the operable stage: In Philadelphia we see less than 10%. However, this is an arbitrary question, for what one surgeon considers operable may be viewed differently by another. All authorities, however, agree that the proportion of cases seen early is small."

Polak (Professor of Gynecology, Long Island College Hospital) has this to state concerning the Wertheim operation:

"Primary mortality: The radical operation for cervical cancer is the most serious procedure that the gynecologist is called upon to do; for the extensive dissection which is necessary imperils the integrity of the ureters, bladder and rectum—and aside from the danger of trauma to these structures, the wide exposure of cellular tissues opens up avenues for streptococcic infection and fatal peritonitis; for it is well known that these proliferating carcinomatous growths are frequently the abode of the streptococcus. Furthermore, pieces of carcinomatous tissue may be implanted in the operative area. Hence it will be seen that the blood loss, traumatism, prolonged anesthesia, and infection, all contribute their share to the primary mortality. Hemorrhage, shock and peritonitis are the usual causes of death.

"In this country, the primary operative mortality ranges from 8% to 20%; in Europe from 5% to 11%. It may, therefore, be conservatively stated that even in the hands of the most competent surgeons, 10% is a fair average. Thirty percent of cures after the five-year period is about all that can be claimed for the radical operation by even the best American operators."

Wight (Associate Professor of Gynecology, University of Oregon) states the following concerning the radical operation:

"We may differ as to the relative value of surgery or radium in early cases of cervical cancer, where the disease is limited to the cervix alone. But if operation is decided upon, a simple hysterectomy is of about as much value as no treatment at all. A complete Wertheim operation should be performed, with removal of a wide cuff of vagina, stripping of all tissue along the ureters for two or three inches, and thorough cleaning out of the lower pelvis of all fat and muscle. This is truly a radical piece of work and because of poor condition of the patients, prolonged anesthesia, etc., even the most skillful operators in the best clinics have a primary operating mortality of from 7% to 10%. If this primary death rate occurs under the most favorable conditions, what will the operator's percentage be who may do one or two such operations a year? Is this fair to our patients?

"Lastly, a few of our profession need to bear constantly in mind the text that was ever before them in medical school days, that the benefit and welfare of the patient was the first and main consideration of our work and that financial recompense for ourselves came later. If this were more closely followed, cancer mortality would be lowered."

At the recent International Conference on Cancer, held in London in July 1928 under the auspices of the British Empire Cancer Campaign, the surgical treatment of cervical cancer was thoroughly discussed by two of London's leading surgeons. In spite of their extensive experience of over 20 years in the radical surgical treatment their primary operative mortality was 15-17 per cent.

Comyns Berkeley stated that during the past 21 years he had performed the radical operation on 661 cases. "The immediate mortality is 17.0 per cent. I make no excuse for this figure. It is no better, it is no worse than the average mortality of the foremost Continental surgeons engaged in this class of work."

Victor Bonney in the period of 1907 to 1927

performed the Wertheim operation 351 times with an operative mortality of 15.1 per cent. "It is true that the number of persons expert in Wertheim's operation in any given country can never be very large, since in order to render them expert a large quantity of that particular variety of clinical material must be allocated to them alone, and the amount of such material in any country each year is limited—For a surgeon whose opportunities occur at the most only two or three times a year to undertake the operation is to bring the operation into discredit, not merely as regards its immediate, but as regards its remote results."

It is doubtful if any surgeon has exceeded the experience of Weibel of Vienna, with the Wertheim operation. In reporting his experience of twenty-five years he saw 3184 patients suffering from carcinoma of the uterus (body or cervix) and performed the radical Wertheim operation 1500 times. In the entire series, the original procedure as outlined by Wertheim was followed and the total primary mortality was 13.8 percent. Five years after operation, 40 percent of all operated patients were free from recurrences. Weibel operates on approximately 50 percent of the patients examined, the remainder being considered inoperable. Unfortunately, his report does not consider carcinoma of the body of the uterus separate from that of the cervix. If this were done, we are sure the percentage of operable cases and the percentage of good results for those patients suffering from carcinoma of the cervix would be less than that given above.

Superiority of Radiation Methods

The superiority of radium over surgery in the treatment of cervical cancer is now generally recognized by surgeons and gynecologists all over the world. In a number of the leading surgical clinics of this country the radical operation for carcinoma of the cervix has not been used for more than five years. In fact, the majority of the more prominent gynecologists have abandoned surgery in the treatment of this condition. This is best proven by the opinions of these men themselves, and in reading their statements which follow, it is well to remember that they are surgical gynecologists and not radium therapists (except Drs. W. J. Mayo and J. C. Masson who are general surgeons).

Wm. P. Healy, M.D., F.A.C.S., Gynecologist, Memorial Hospital, New York City. (America's largest cancer hospital, and where radiation methods have been used exclusively in the treatment of cervical cancer for a number of years). Am. J. Obst. and Gynec., 10:797, December, 1925.

"Enough statistics on end-results of treatment of carcinoma of the cervix by irradiation are now available from reliable observers and clinics throughout the world to indicate that hysterectomy is no longer necessary. Evidence is accumulating to indicate that hysterectomy for carcinoma of the cervix even combined with pre- or postoperative irradiation, or both together, may be a serious handicap to the patient's obtaining the full benefit of ray therapy. Evidence would seem to justify the careful, continuous, intensive treatment of all cases of carcinoma of the cervix with combined radium and roentgen therapy. Surgery has definitely failed in the treatment of carcinoma of the cervix. Irradiation therapy is not ideal but represents a real epoch in the treatment of the disease."

That Healy had not changed his opinion three years later is evidenced by the following statement: "Hysterectomy is no longer justifiable as the treatment of carcinoma of the cervix, based upon five year end-results." (Medical Journal and Record, Jan. 4, 1928).

In July 1928, before the International Conference on Cancer held in London, Healy stated: "The treatment of carcinoma of the cervix by radium and x-ray would seem to offer better results than surgery, without the attending operative mortality."

One of Healy's most recently published statements follows (Radiology, March, 1930).

"We are of the opinion that the large number of advanced cases constantly seen, because of difficulties of early diagnosis, makes it extremely improbable that we shall obtain more than 40 to 50 per cent of five year cures by radiation or surgery, singly or combined, in the favorable cases. By favorable cases we mean the so-called clinically early and borderline groups.

"When we speak of surgery as giving such a high percentage of five year cures we refer to the radical Wertheim operation, and one must not, of course, overlook the high associated primary mortality of about 15 to 20 per cent with this operation, as against a mortality of 1½ to 2 per cent from radiation therapy. Moreover, there are very few sur-

geons who can hope to achieve the high percentage of cures referred to with hysterectomy whereas practically all specialists of experience in radiation therapy seem to obtain about 40 to 50 per cent of five year cures."

Charles C. Norris, M.D., F.A.C.S., Professor of Gynecology and Obstetrics, University of Pennsylvania School of Medicine, J. A. M. A., 90:200, Jan. 21, 1928.

"A definite trend away from the more radical hysterectomy with its high operative mortality and frequent postoperative complications can be observed in this country as well as abroad. The chief reason for this is that when carefully analyzed the end-results obtained are no better than, if as good as, those secured by irradiation. In the Clark Clinic we have not submitted a case of cervical carcinoma to hysterectomy for five years, and this despite the fact that Dr. Clark was one of the pioneers in the development of this operation, his operations and those of Reis of Chicago having preceded Wertheim by a number of years."

H. S. Crossen, M.D., F.A.C.S., Professor of Clinical Gynecology, Washington University School of Medicine, South. M. J., 21:300, April, 1928.

"Our general plan of treatment of cancer of the cervix uteri is to give a heavy dose of radium, as large as can be given without danger of sloughing into the bladder or rectum, and then follow this at a selected time by deep x-ray therapy of the highly penetrating type. This has been found to be the most effective plan of treatment in nearly all cases in the stage, at which patients come under observation. It stops the bleeding and checks the growth better than any other form of treatment and also gives a better chance for permanent cure. It is only occasionally that a case of cancer of the cervix is seen early enough to warrant operative removal. In those exceptional cases in which we feel operation is justifiable, the plan followed is first to give a heavy dose of radium as though we were going to depend on radium for the cure. Then within a short time (two to ten days) the hysterectomy is carried out, and later this is followed by deep x-ray therapy. This program gives these very early cases the benefit of both operation and radiation."

Howard A. Kelly, M.D., F.A.C.S., Emeritus Professor of Gynecology, Johns Hopkins University Medical Department, in his latest book "Gynecology," D. Appleton & Co., 1928 (Kelly is one of the American pioneers in radium therapy and has used radium in gynecology for over twenty years.)

"On acount of the numerous distressing recurrences even in this hopeful group (carefully selected early cervical carcinomas), there is a growing inclination to decline operation in favor of radium. Radium usually clears up permanently all early cases and a number of those with moderate lateral infiltration and occasionally one of the advanced inoperable group . . . A great advantage of radium lies in the prolonged period of improvement following treatment. It brings a promise of solace not only to the curable but to the incurable as well."

George Gray Ward, M.D., F.A.C.S., Professor of Gynecology and Obstetrics, Cornell University Medical School. Am. J. Obst. & Gynec., 17:12, Jan. 1929.

"There is less primary mortality, less morbidity, less loss of time with radium than in the radical operation for carcinoma of the cervix. The palliative results in cases not permanently cured are an important advantage, not to be ignored. The morbidity results of the radical operation—fistulas, thrombosis, suppuration, etc., are not to be forgotten.

"Large amounts of radium are not necessary to produce results. We believe that our results show that radium is preferable in all classes of cervical carcinoma. We also believe that in very early cases the radical operation will give the same results as radium but at the cost of high primary mortality and greater morbidity. We agree with Polak's statement that all borderline cases fall within the range of radium and not operation. As to early cases—and how few we see—with the present statistical figures available, it is not proved which gives the best results, but available figures do *not* show that operation is any better than radium." (Dr. Ward has not performed the radical operation for cervical cancer since 1920.)

Henry Schmitz, A.M., M.D., LL.D., F.A.C.S., Professor and Head of the Department of Gynecology, Loyola University, School of Medicine. Am. J. Obst. and Gynec., 19:704 (May), 1930.

"If radiation therapy is employed on all cases, even in these of Group 1, we will reduce the mortality and morbidity inherent in surgical treatment and will definitely increase

the number of five-year, good end-results. Since 1917 we have treated all our cases with radium and the results have been excellent. Statistics may prove anything, but they do give relatively reliable information of what can be done and therefore cannot be discarded.

"Much is yet to be learned about x-ray and radium therapy, and as progress in technic is made we may expect even better end-results."

Malcolm Donaldson, M.B., F.R.C.S., Physician-Accoucheur to St. Bartholomew's Hospital, London, in Fitzwilliams' "Radium and Cancer." William Wood & Co., New York, 1930.

"It has well been said that the history of radium therapy is the history of radium in gynecology, as it is in this field that the value of radium in connection with malignant diseases was first demonstrated on a large scale. Moreover, carcinoma of the cervix is a comparatively radio-sensitive growth, and there are very few vital organs near which might be affected by wrong or at any rate inferior technique, so that good local results have been obtained even by the most crude methods.

"This is not the occasion to discuss the question of operation versus Curietherapy, although in the mind of the writer the future lies entirely with the latter treatment. It is sufficient to state here that the statistics of five years' survival in the best radium clinics already show us good a percentage as that obtained by operation, and of course, without the large initial mortality which inevitably accompanies any considerable series of Wertheim's hysterectomies."

Wm. J. Mayo, M.D., F.A.C.S., Surgeon and Chief of Staff, Mayo Clinic, J. of Medicine, 6:467, Dec., 1928.

"Cancer of the cervix, even in the earliest stages is certainly as well treated by radium as by hysterectomy, and in the advanced cases in which hysterectomy is not possible, radiotherapy will occasionally give splendid local results. Even though metastatic processes later appear without local recurrences, the benefit is as lasting as could be produced by the knife."

James C. Masson, M.D., F.A.C.S., Associate Professor of Surgery, Mayo Foundation, University of Minnesota, School of Medicine. Bul. Jackson County M. S. (Kansas City), 33, Mar. 2, 1929.

"Carcinoma of the cervix always shows a high degree of malignancy and pathologically is very extensive so that most cases when they come for treatment are inoperable. Out of 327 cases of cancer of the cervix that came to the Mayo Clinic in 1927 only seven were operated (97.7 per cent inoperable). . . . The roentgen-ray and radium are especially useful in the treatment of late cases of cancer or in the borderline cases."

The Radium Treatment

Donaldson (one of the foremost gynecologists of England), briefly states the evolution of radium therapy in the treatment of cervical cancer: "The evolution of treatment in any disease starts with treatment carried out on patients in whom the disease is so advanced or whose general condition is so serious that it is felt that nothing can make them worse and that there is a possibility, however small, of helping them. This was true years ago in the case of radiotherapy, and only the quite hopelessly inoperable cases of cancer of the cervix were treated. As time went on it was found that radium therapy not only improved quite a large percentage of such cases, but in a small percentage the patients died later of some other disease and were shown by autopsy to have been cured of the cancer. Then the question arose, if this could be done in cases far beyond the scope of excisional surgery, was it not justified to use the same treatment in early cases? The next step was to try this treatment on patients in whom, although technically operable, a severe operation was deemed inadvisable owing to general condition of ill health, such as heart disease, etc. Here the results proved more encouraging than in the advanced conditions, and gradually a certain number of surgeons were so convinced of the value of this treatment that they gave up hysterectomy altogether.

"To sum up, it can be said that in early, that is to say operable cases, the five-year survival rate fully justifies any surgeon relying on radiotherapy. In the case of patients in whom the disease has become too advanced for operation, there is no treatment as yet which will in any way give such good results as are obtained by radium and x-rays."

The local and symptomatic effects of radium treatment in carcinoma of the cervix are striking and among the most brilliant secured in the treatment of deep-seated malignancies. Hemorrhage and discharge, pain and

discomfort are lessened or entirely checked and the patient usually becomes imbued with a new feeling of life—after undergoing proper radium treatment. The question of the permanency of these results depends upon the general condition of the patient, the type of growth and *the extent of the disease when the treatment is begun,* the latter being, without doubt, the greatest factor of all. The importance, therefore, of an early diagnosis cannot be stressed too much, for the life of the patient depends upon this determination, and upon adequate radiation dosage in the initial treatment.

Rationale of Radium Therapy

Radium has a three-fold action in malignancy, affecting the cancer cells, connective tissue, and blood and lymph vessels.

The action on cancer cells is selective, they being more susceptible to the radium rays than normal cells. This is evidenced, microscopically, by swelling and vacuolization of the protoplasm and shrinking of the nuclei; this is followed by phagocytosis and absorption, and the space occupied by the destroyed cells is replaced by a homogeneous connective tissue.

The parametrial cellular reaction plays a large part in the beneficial effects produced by radiation. Under the influence of the rays this connective tissue proliferates, contracts and hardens, and blocks malignancy by the production of dense formation of scar tissue. It thus favorably affects the cancer cells, the lymphatics and the smaller blood vessels by starving the growth. It has a similar effect to that obtained by ligation of the internal iliac arteries without the danger of trauma and infection.

American Methods of Radium Therapy

Numerous methods for applying radium in cervical cancer have been advocated by various American workers. Space will not permit even an enumeration of these different technics. In general the tendency has been:

1. Use of medium to large amounts of radium (100 to 1,000 mgs.).
2. Use of moderate filtration (0.5 mm. silver plus 1.0 mm. brass, or more lightly filtered needles).
3. Use of but few radio-active centers.
4. Entire treatment given in a short space of time.
5. Radium applied promptly when diagnosis has been established with little or no preliminary treatment.

Regaud (Paris) Technic of Radium Therapy

The splendid results which Regaud has accomplished in the treatment of cervical cancer have attracted the attention of radiologists everywhere. Claude Regaud is the Director of the Radium Institute of the University of Paris, and is the associate of Madame Curie. His reputation among radiologists is universally acknowledged and there is, perhaps, no other who enjoys greater prestige as a radiation therapist. The Radium Institute of Paris is one of Europe's leading cancer clinics, and Regaud, as its Medical Director, has had exceptional opportunity for clinical study. In addition to this, there has been available for his use one of the largest supplies of radium in the world—9.5 grams.

The cardinal principles of the Regaud (Paris) technic are as follows:

1. Proper preliminary treatment.
2. Rigorous asepsis.
3. Use of comparatively small amounts of radium over a long period of time, applying the greatest possible dosage without injury to surrounding normal tissues.
4. Employment of a number of radio-active centers distributed throughout the entire uterine canal and in the vagina.
5. Use of *heavy* filtration (by dense metals such as gold or platinum) which permits only the deep penetrating gamma rays of radium to be emitted, thereby avoiding necrosis of the tissues.
6. Use of external radiation, in addition to the intra-utero-vaginal radium therapy, when the growth has extended beyond the uterus.

For nearly three years we have utilized the principles of the Regaud method with certain modifications. The clinical results secured have been so eminently satisfactory that we are describing our technic in detail:

Pre-Radium Treatment

Examination: The patient should first be carefully examined, not only to determine the extent of the local disease but to ascertain the general condition, especially if any metastatic malignancy is present. It is important that the gynecologic examination be done

gently as rough examinations have a tendency to disseminate the disease. Upon the results of the gynecologic examination, the patient should be classified as having a Group 1, 2, 3, 4 or 5 cervical cancer in accordance with the classification of Schmitz. In making the gynecologic examination, it is important *to determine if the uterine canal is patent, and if so, to ascertain and record its length* by means of a sound. A biopsy of the lesion should be taken at this time. Biopsy carries insignificant hazards in cervical cancer because the lymph and blood channels are already blocked by the ulceration that is invariably present.

X-ray Therapy. If the growth is in the Group 1 class, radium alone may be depended upon to cure the condition, but in the more advanced conditions it should be supplemented with high voltage (200,000 volts) x-ray therapy, administered by a competent roentgenologist. It is most important that this be done if the growth has extended beyond the uterus (parametrial involvement, etc.), as intra-utero-vaginal radium treatment alone will not, as a rule, cure these patients, although it will usually render great palliation. The purpose of the x-ray therapy, supplementing the radium treatment, is to secure the combined action of the x-rays (in the peripheral part of the neoplastic territory) and of the radium in the uterus and vagina. For the best results it is perhaps better that the high voltage x-ray therapy be given first, followed immediately by the principle radium treatment (provided the uterine canal is patent).

Cervical Infection. Local infection invariably accompanies cervical cancer at the moment it opens into the vagina, and for this reason few patients present themselves in a condition which makes immediate radium treatment desirable. The infection usually progresses with the progress of the cancer and probably does as much, if not more, to break down the resistance of the patient than does the growth itself. The infection is at first superficial, but later it extends deeply. The infiltrations that one palpates may be due to infection, new growth, or both. If an attempt is not made to first control this, radium may transform the local infection into an acute pelvic cellulitis, a suppurative salpingitis, a circumscribed phelegmon of the pelvic tissue, a generalized peritonitis, or a septicemia.

To control the infection, it is necessary to give copious, warm, mild antiseptic vaginal douches, several times each day. Kaplan, in describing the method used at Bellevue Hospital states: "Treatments are planned according to the extent of the lesion present in the vagina, a course of disinfection with douches initiates the treatment. The patient is shaved and cleansed externally; the bowels are cleansed with enemas. Douching with boric acid solution or with 2 per cent glucose solution, twice daily, is carried out until the vagina has been thoroughly cleansed and much of the induration about the cervix reduced. Following this, the vagina is irrigated with 2 per cent methylene blue solution, a mild antiseptic which seems to clear up the infection more rapidly. Radiation is not begun until the disinfection or cleansing is completed, so that little infection is present in the vagina when the treatment is applied. Meanwhile, the general condition of the patient, is improved by dietetic and hygienic methods. Constipation, which is present in nearly all cases, is treated by mineral oil and magnesia, and enemas if necessary."

Warm vaginal douches, twice daily, of two quarts of a saturated solution of boric acid, followed by eight ounces of 1 to 1,000 acriflavine in normal saline, is another method that will usually be found quite effective in controlling the local infection.

During this time the patient is not confined to bed. After a week or 10 days of this preliminary treatment, the cervix should be gently dilated by the use of graduated sounds and the length of the uterine canal again verified. The patient is then kept in bed for 24 hours and the temperature recorded at frequent intervals. If there is no increase in temperature, the patient is ready for the intra-utero-vaginal radium treatment. (In advanced cases, the preliminary treatment described above can be given while the patient is receiving high voltage x-ray therapy.)

Non-Patent Cervical Canal. When the cervical canal is filled with a cauliflower growth, or an ulcerating growth at the external os, and localization of the cervical canal is impossible, the principal internal radium treatment cannot be given. Such cases should receive preliminary radium treatment or the cervix should be removed by electro-thermic measures.

For the preliminary radium treatment to clear away the excrescences, we usually insert

12.5 milligram radium needles into the carcinomatous area. The number will vary according to the amount of involvement, but usually four are sufficient. They are deeply imbedded, kept parallel to each other and to the long axis of the cervix and are kept about 1.5 cm. apart. They are left *in situ* for 20 hours.

Kaplan, Pfahler, and others, advocate the amputation of the cervix, or the removal of malignant masses by electrothermic means, immediately preceding the insertion of radium in certain cases (small per cent) of cervical cancer—as when the cervical canal is obstructed by a large cauliflower growth blocking the vagina, or, if there is much hypertrophy of the cervix associated with a large amount of fibrous tissue, which may help to shield carcinoma cells. When such treatment is carried out, preliminary radium treatment is not necessary, as the uterine canal is rendered patent and the principal radium treatment can be readily carried out. Sometimes complete removal is not possible. In such instances, as much growth as feasible is removed and then radium needles are inserted in the remaining mass. When the mass has receded, the uterine canal may be located and the principal radium treatment carried out.

If preliminary radium is used, the uterine canal usually becomes sufficiently patent in 10 to 20 days, to permit the introduction of an intra-uterine radium applicator. In fact, these cases usually respond remarkably well to such preliminary radium treatment, and there is danger of the patient or physician thinking that further radiation is not necessary, because the excrescences have cleared up so readily.

Preliminary radium treatment, or electrothermic amputation, is absolutely necessary in all cases, where the growth has proliferated to such an extent as to occlude the cervical canal, if the maximum results are to be secured. The principal radium treatment should not be given until the uterine canal is rendered patent. The best results from radium, in cervical cancer, can only be secured by treating the entire uterus. This necessitates the predetermining of the length of the uterine canal, in order that the proper type of applicator may be provided. (If the cervix is to be amputated, the length of the uterine canal will be shortened and the radium therapist must consider this factor when constructing the intra-uterine applicator.)

General Considerations. In addition to the above mentioned outline, every effort must be made to eliminate sources of focal infection and to increase the general health of the patient by a high vitamine diet, etc.

Radium Treatment

The radium applicators are two in number: a "T" shaped intra-uterine applicator designed by the author, and a double barreled vaginal applicator, called the Kaplan colpostat. Both instruments provide heavy gold and aluminum filtration * and permit only the hard gamma rays of radium to be emitted, thus avoiding any caustic radiation. In the author's applicator, a radium center (usually 12.5 milligrams) is placed for each 2 to 2.5 cm. in the uterine portion of the applicator and one center in the cross-arm piece in the vagina. Therefore, in the average size uterus (uterine canal measuring 6 to 7.5 cm.) there is a total of four radium centers in the applicator. The Kaplan colpostat contains one radium center in each of the rubber barrels (usually 12.5 mgs. each) making a total of six radium centers in both applicators for the average case, or 75 milligrams. If the uterine canal is longer or shorter than normal, the number of centers will vary, the object of the treatment being to thoroughly radiate the entire length of the uterus.

The patient is prepared as for a major gynecologic operation. The vulva is shaved, castor oil catharsis and douche given the evening before, and a cleansing enema and douche on the morning of the radium insertion, no breakfast being permitted. It is imperative that strict aseptic precautions be used throughout the entire radium application and that all manipulations be done gently. (Quigley states. "solid cancer is surrounded by a zone of liquid cancer which contains in suspension the seeds for the recurrence and the transplantation of the growth. This liquid cancer is the cause of dissemination of the disease when the diseased part is subjected to rough examination or rough operative manipulation.")

A general anesthetic is objectionable as it reduces the patient's resistance to cancer. (In experimentation on animals, cancer growth is always speeded up after a general anesthetic—either chloroform or ether.) Usually, patients get along comfortably with a large dose of

* The filtration in the uterus is equivalent to 1.5 mm. of pure platinum and in the vagina 2.5 mm. to 3 mm. of platinum.

morphine or scopolamine-morphine, (one H. M. C. Tablet No. 1), hypodermatically, half an hour before treatment is started.

The patient is placed in position as for a gynecologic examination. A large sized bivalved speculum is inserted and the vaginal cavity and cervix thoroughly cleansed with mercurochrome.

The cervical canal is dilated very gently and slowly in order to introduce the special "T" shaped radium applicator. This applicator is especially prepared to treat the case in hand, being arranged to extend the entire length of the uterine canal. The greatest care must be exercised not to traumatize the carcinomatous cervix, dilatation being secured by means of metal dilators (Hegar) of graduated size. If this is done cautiously, discomfort or hemorrhage is usually avoided. The conventional Goodell dilator should NOT be used—it is liable to cause serious trauma. A small specimen should always be removed for microscopic study, if this has not already been done. When the canal is properly dilated, the uterine radium applicator (which should be sterilized) is readily inserted by means of a special forceps, or semi-flex handle. (A little K-Y Jelly placed on the end of the applicator will facilitate ready insertion.) The applicator is introduced so that the cross-arm piece rests against the cervix with its long axis anteroposterior. Following this, the vaginal applicator is inserted. This is the Kaplan colpostat, a modification of the Curie colpostat. It is placed in the vagina with the spring bent. (As we prepare the Kaplan colpostat it is covered with a layer of ametal rubber in order to prevent the heavily filtered, gold capsules, which contain the radium, from slipping out of the barrel-ends. It is important, therefore, that these barrels be covered with K-Y Jelly to prevent them from adhering to each other.) The barrels containing the radium are pushed in place on either side of the cervix (lateral vaginal fornices) and the spring tension holds them in the region of the parametria.

Now comes one of the most important steps in the entire technic—the proper vaginal packing. About 10 yards of sterile, 2-inch gauze, wrung out in acriflavine solution, 1 to 4,000 normal saline, should be used in thoroughly packing the anterior and posterior fornix, then, the ENTIRE VAGINA. The object of the packing is to hold the radium applicators in position and to *push* the rectum and bladder as far away as possible from the radium, for these organs are quite sensitive to radiation. The dressing is completed with a "T" binder and the patient put to bed and instructed to keep in the recumbent position. She must not sit up but can be somewhat elevated with pillows.

On account of the voluminous vaginal packing, urination is usually difficult. This can be overcome by leaving a retaining catheter in the bladder or by catheterizing every 6 hours. The applicators are left in position for a total of 100 hours or 7,500 milligram hours in the average case. (In the infrequent Group 1 growths, a 75-hour treatment is usually sufficient.)

During the entire time the radium is in position, the patient is kept on a light, low proteid diet, and fluids are given copiously, especially lemonade and orangeade, which help to eliminate, to a great extent, the tendency to radiation sickness (nausea, vomiting and general malaise). The bowels are allowed to rest. Usually the patient is more comfortable if the head of the bed is somewhat elevated. If pain is present, codein is administered. If the temperature reaches 103° or chills occur, the radium applicators are removed, a vaginal douche and enema administered and the patient allowed to rest without radiation for 12 hours, or until the temperature is practically normal.

Post-Radium Treatment

After removing the radium, the patient should be placed in the Fowler position. In a few hours a hot, sterile, normal salt douche, and an enema is administered. If the temperature is normal, she is permitted to get up the following day for a short period. While in the hospital, she should receive a boric acid douche daily. Before going home, she should be instructed to take a daily boric acid douche for at least one month, and the bowels should be kept open by suitable diet and mineral oil She should report for examination twice a month, until the reaction of treatment has been completed, and then bi-monthly for one year. Cervical stenosis with the possible development of pyometra, can be avoided by the passage of a uterine sound four or five weeks after the treatment. This, however, is an infrequent complication.

In Group 2, 3, or 4 types of cervical cancer, a course of high voltage (200,000 volts)

x-ray treatment, administered by a competent roentgenologist, should be given *before* the radium treatment or, should immediately follow. As previously mentioned, this is most essential when the tumor has already extended beyond the uterus, as the likelihood of controlling such growths with radium alone is not good.

If the growth shows no response, (rare cases), further treatment is of no avail. If a large tumor mass has diminished but at the end of two months has not disappeared, additional radium treatment will usually give good results. It is questionable, however, if the typical complete treatment should be repeated. In some patients it may be advisable to repeat the series of high voltage x-ray therapy.

The question is often asked as to whether the uterus should be removed after the radium treatment. If the histologic report shows the growth of the cervix to be an adenocarcinoma, (about 3 per cent), a radical hysterectomy, four to eight weeks after the treatment, is perhaps advisable (if the growth is operable), for these tumors, as a rule, are rather refractive to radiation and are prone to recur. Surgery *should not* follow any other type of growth, unless the patient was clearly an operable risk before the radium treatment. Even in such patients, the results from irradiation, alone, are so satisfactory that the operative risk of radical hysterectomy fraught as it is with so many dangerous complications, is not worth the chance taken.

Rationale of Large Radium Dosage Slowly Administered

It has been definitely established that in the course of their existence cancer cells pass through alternating phases of radio-sensibility and radio-resistance. The cells are particularly radio-resistant when they have been in a state of rest for a long time. They are most sensitive to the action of radium when they are in the state of mitosis, or indirect cell division. The use of a large amount of radium for a short period of time will only destroy those cells which are, at the moment, in a state of maximal radio-sensibility, or a treatment by repeated doses over a certain period of time, will destroy all the mother cells successively. As the cycle of cellular renovation continues, each cell passes at some time into the phase of maximal sensibility. At the same time the patient is saved a severe reaction, which is common when the time of irradiation is short and the amount large.

By the use of heavy filtration the caustic effect of any *beta*-ray radiation with its attending necrosis, is eliminated. The treatment interval is necessarily prolonged which, as previously mentioned, increases the chance of destroying additional carcinomatous cells.

Results

The statistics of Regaud, at the Radium Institute of the University of Paris, concerning the use of radiation methods in carcinoma of the cervix have been among the most encouraging published. During the period 1919-1926, 678 patients suffering from cervical cancer were treated at Regaud's clinic (12 per cent Group 1, 28 per cent Group 2, and 60 per cent Group 3 and 4). Of this number 610, with a histologic diagnosis of carcinoma, are available for statistical purposes (10 per cent Group 1, 35 per cent Group 2, and 55 per cent Group 3 and 4). The mean percentage of clinical (provisional) cure was 30 per cent. The results secured have shown a yearly improvement since the method was adopted in 1919, i. e., the percentage of five year cures in the Group 1 patients increased from 20 per cent in 1919 to 81 per cent in 1923 (the latest year for which five year statistics are available); Group 2 patients from 33 per cent in 1919 to 43 per cent in 1923; Group 3 and 4 from 3 per cent in 1919 to 13 per cent in 1923. The total five year cures, representing the entire series (610 patients) with all degrees and extensions of the disease, increased from 8 per cent in 1919 to 32 per cent in 1923. Of the 1926 group (93 patients), the latest group on whom published statistics are available, 72 per cent were living one year after the treatment. The above figures are all the more remarkable when it is recalled that 90 per cent of the patients were doubtfully operable or inoperable when the treatment was begun. The results are among the best published from a large radiologic clinic and representing as it does, one of Europe's foremost cancer clinics, carries great weight and the methods used are worthy of careful study.

Surgical Versus Radium Statistics

In studying the final statistics, it is unfair to compare operative results, which in reality only record those women who have survived

the operation, with those obtained by radium and high voltage x-ray therapy which includes "all comers."

For example: Of 100 cases of cancer of the cervix applying for operative treatment, at the most only 50 can be accepted as operable and of these at least 5 will die from the operation; so that of the 45 surviving the operation 13 or 30 per cent can be expected to survive the 5-year period. Consequently, of the 100 cases only 13 are alive at the end of 5 years.

With radiation, virtually all of the 100 will be accepted for treatment, and of this number we can expect 25 to be alive at the end of 5 years with practically no primary mortality. The 5-year end-results with proper radiation treatment are, therefore, approximately 100 per cent better than with the radical surgical treatment.

A few years ago (1922) the American College of Surgeons appointed a "Committee on Treatment of Malignant Diseases with Radium and X-rays" to investigate the subject thoroughly. On this committee were placed some of the most eminent surgeons of America—Crile, Mayo, Finney, Ochsner, etc., with Greenough of Boston (Assistant Professor of Surgery, Harvard Medical School) as Chairman. The first subject this committee chose to study was carcinoma of the cervix. In their preliminary report they called attention to another point well worth remembering in the use of radiation methods—the considerable delay in mortality. The duration of life in the unsuccessful cases is greater with radium than with surgery; while it may be further stated that in the unsuccessful cases there is a marked amelioration of the symptoms complained of, the pain is less, the bleeding negligible and sepsis is absent. "The value of radium as a palliative measure in advanced cases is beyond dispute."

Advantages of Regaud (Paris) Technic

The Regaud (Paris) technic of treating cervical cancer is an efficient, slow, intensive method of radium therapy, which apparently has a number of advantages over the radiation methods that have generally been used in this country. These are: 1. The preliminary treatment controls to a large extent the accompanying local infection, thus increasing the patient's general resistance.

2. The careful aseptic technic of radium application prevents severe infection following the treatment.

3. The small amount of radium used prolongs the radium treatment, thus increasing the possibility of administering the radium when the cancerous cells are in a state of maximal radio-sensibility.

4. The employment of multiple centers of radio-activity with wide distribution offers a more uniform radiation, and permits a large radium dosage to be administered, not only to the visible growth but also to the zone of potential malignancy which surrounds it.

5. The use of heavy filtration protects the normal tissues and possible fistula formation, and prolongs the treatment, thereby increasing the chance of destroying additional carcinomatous cells.

6. The use of external radiation in supplementing the intra-utero vaginal radium therapy, greatly increases the total radiation dosage, especially in the peripheral part of the neoplastic territory.

Surgery Versus Radium

In finally evolving the relative merits of radiation and surgery in cervical malignancy, Polak (Professor of Gynecology, Long Island College Hospital) has called our attention to a number of factors that are well worth remembering.

"Experimental study of the behavior of implantation cancer allows us to draw an analogy between its behavior in animals and when similarly located in man. These experiments have shown that where cancer is properly nourished, the graft takes, but the growth usually remains localized and fails to metastasize—in other words, the animal established an immunity against the cancer's further growth, and the implant may remain localized for months or years, or as long as the animal remains in good health. On the other hand, if this animal is subjected to repeated or continuous blood loss, the growth, which up to this time has been quiescent, rapidly develops and metastasizes; or if the tissues immediately surrounding the graft are traumatized, the implant grows with rapidity; or again, if the animal is subjected to prolonged ether, or chloroform anesthesia extension of the growth into the surrounding tissues is stimulated.

"These three conditions: i. e., blood loss, trauma, and prolonged anesthesia, obtain in every radical operation for the removal of a

malignant growth. Therefore, it may be presumed that in the woman suffering from cancer upon which the radical operation is done, the immunity which she has developed against the growth, for the time being at least, is broken down—and if metastasis has already occurred, or if the operation has not completely removed every vestige of the tumor, rapid recurrence may be expected; for her tissue reaction has been reduced by these three factors.

"The radical operation has a primary operative mortality of from 7 per cent to 20 per cent which must be taken into consideration in evaluating the results of surgery versus radium. Radium and x-ray, on the other hand, may be used without increasing either the blood loss, or traumatizing the surrounding healthy tissues, and may be applied in many instances without a general anesthetic.

"Furthermore, irradiation of the parametria with the x-ray establishes a connective tissue barrier which limits the lymphatic extension. This is especially valuable in cervical cancer, for in this type of growth extension and recurrence is confined to the pelvis, and is, therefore, more readily attacked."

Summary

1. Carcinoma of the cervix should be diagnosed in its earliest stage and radium treatment administered promptly, preferably by the Regaud (Paris) technic.

2. The surgical treatment of cervical cancer should be virtually abandoned since better results are secured by proper radiation treatment.

3. The great majority of uterine carcinomas should receive a course of high voltage x-ray therapy, administered by a competent radiologist, either before or following the radium treatment.

4. Reliable statistics show approximately 30 per cent of cervical cancers, representing ALL stages free from the disease five years after radiation treatment.

Conclusions

We believe the results enumerated above are encouraging and that they can be approximated by the conscientious physician who is properly prepared to treat cervical cancer by radiation methods. They are obtained, it must be remembered, with practically no mortality resulting from the treatment, which cannot be said of the surgical method.

The outlook for the patient with cervical cancer has, therefore, been vastly improved by the introduction of radiation therapy. The simplicity and ease of application of radium in uterine malignancy makes radium therapy a part of the physician's armamentarium, which should do much to hold out hope to many women suffering from cancer, who heretofore have been doomed to die because the means of aiding them was not sufficiently close at hand.

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FACTORS DETERMINING ULTRAVIOLET DOSAGE AND COURSES OF TREATMENT *

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Successful therapeutics requires not only an understanding of the pharmaco-dynamics of the remedies employed, but, also, the administration of these remedies in the amounts necessary to obtain the desired effect. To exceed the physiologic dose may defeat the purpose just as much as an inadequate dose fails to accomplish results. With the use of standardized extracts, alkaloids, and pure synthetic chemicals in present day practice, we still find wide differences of opinion as to what amounts constitute a proper dose even with the most commonly used medicines. From the one extreme of those who advocate pushing a drug to the extreme limit of tolerance or at least in quantities that produce definite objective indications of its action we have all variations to the other extreme of the homeopathic school.

We fully realize that in venturing upon the subject of posology where so much controversy exists even in respect to drugs that are subject to precise measurement of quantity and effect we are inviting criticism, and that such an attempt to fix certain standards and rules is likely to encounter many differences of opinion. Nevertheless, it is an issue of paramount importance and, for this reason, we offer these observations that have been helpful in the practice of light therapy.

The problem of determining the degree of exposure and course of treatment is by no means confined to ultra-violet therapy. X-ray therapy was in use long before modern artificial sources of ultraviolet rays made possible the use of these emanations in measured quantities and, yet, what radiologist will attempt to predict the amount of radiation a case of hyperthyroidism or malignancy will require to accomplish a maximum result? Nevertheless, we believe an examination of the clinical and experimental observations of the past nine years on the effects of ultraviolet on the human economy makes it possible to lay down certain principles that will place its therapeutics on a more definite basis and establish a standard of what constitutes good practice.

The first step in placing this indispensable item of our armamentarium on a more scientific position is to eliminate some of the confusing terminology that now exists. The designation of these higher frequencies of radiant energy under the broad, indefinite name of ultraviolet, which in its literal sense would include all frequencies beyond those of visible light is in itself misleading, and has been a considerable factor in the merchandising of apparatus that comes far from producing an ultraviolet radiation of any real therapeutic value.

It is a well known fact that a wide range of frequencies exists between the glass filterable, erythema producing, anti-rachitic rays and the visible rays. So far as their physiologic effect is concerned, these wave-lengths between 3900 and 3150 Angström units are identified with that of visible light and, strictly speaking, they may be called ultraviolet rays; and lamps are being used for supposed nutritional effects that have a negligible output of any wave lengths beyond this region. The same inaccuracy applies to the so-called "far" ultraviolet region of the spectrum. The experiments of Hausser and Vahle with filters as well as those of Leonard Hill and his associates indicate quite positively that the important, physiologic rays are confined to a com-

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paratively narrow band in the spectrum, lying between 3150 and 2800 Angström units, and most of the effect is obtained from an even more restricted band between 2900 and 3000 Angström units. These wave-lengths correspond closely to the absorption bands of ergosterol, oxygen, egg albumin, and the amino acid derivative of protein, such as tyrosine and phenolalanine. The importance of these absorption bands is only appreciated if we remind ourselves that radiant energy to be effective must be absorbed.

For lack of more descriptive nomenclature this band between 3150 and 2800 Angström units has been referred to as the Dorno-ray region. We believe it would be a step forward if we stopped speaking of the ultraviolet ray and use the term "Dorno-ray", when referring to this kind of radiant light energy.

We have been accustomed to describing the intensity of an exposure in terms of skin-burner distance and duration of time. For practical purposes the effect of the Dorno-rays is measured by the erythema reaction on normal, unpigmented skin.

The effect of an exposure from a lamp 20 inches distant, sufficient to produce a first degree erythema, will be identical with that of a lamp 40 inches away with proportionate increase in exposure time, sufficient to produce the same erythema reaction. I have personally tested this supposed selective absorption of these frequencies in air by means of a quartz spectroscope, and these observations confirm the statements of well recognized physicists. Absorption of ultraviolet in the air need not be considered under ordinary treatment conditions, although the reverse holds true in the case of infra-red radiation. Because of this, no purpose is served by specifying Dorno-ray dosage in terms of time and distance. It is far more convenient in view of the variability of sources of light to speak of certain number of erythema units.

While the skin reaction is useful in gauging the intensity of Dorno-ray emission, it is of little value in estimating the amount of systemic effect or catalytic action resulting from an exposure of the body surface.

As Sir Henry Gauvain has said, this latter depends upon the individual's capacity to respond. We have never encountered any so-called helio-phobes, but we can heartily agree that individuals vary markedly in the manner and degree to which they respond to light treatment. Oftentimes this systemic reaction is entirely apart from the degree of skin sensitivity. We have seen patients who had an abnormal skin tolerance to the Dorno-rays but who developed untoward symptoms when radiations were given to the limit of skin tolerance. These same cases showed steady improvement when the exposures were reduced.

Dr. Rienert, at the Mayo Clinic, showed me a convalescent empyema case, as an example, that not only reacted in this manner but, a fact more remarkable, the sensitivity of the skin increased with the clinical improvement. As a matter of fact our personal impression is similar to that of such a well known observer as Rollier, viz., that patients that show a poor or sluggish skin reaction usually respond less favorably in other ways. We have also observed that as repeated radiations are given, there is a tendency for the erythema reactions to occur more quickly following the exposure. It would appear from such experiences that certain receptors are required to bring about this inflammatory reaction.

The question naturally arises: "If we are not to be guided by the effect produced on the skin what indications can be selected as a means of determining the length of exposure time?"

When artificial sources of short wave ultraviolet radiation were first introduced in the treatment of tuberculosis, rickets, and various diseases characterized by disorders of mineral metabolism and impaired function of the secretory organs, very little was understood concerning the *modus operandi* and the method was largely of an empirical nature.

The common procedure at that time was to simply adopt a routine series of daily exposures, beginning with an irradiation that could be easily tolerated and gradually increasing this until a certain maximum was reached beyond which it was considered impractical to go. It soon became apparent that there was a decided variation in the individual response to such applications, some subjects evincing a rapid improvement in weight, vigor, and disappearance of symptoms, while in others the change was much slower, and in some the condition grew worse.

The first step in shedding light on variability in results was the identification through experimental methods of the action of these rays with vitamin activity. So intimate was this relationship found to be that Professor

Baly, the English physiologist, was led to express the dictum, "Vitamins may be interpreted as light phenomena." While there still remains some question as to how conclusively this view can be applied to all the vitamines, the dependence of vitamin D, the so-called "sunshine vitamin", on ultraviolet activity is one of the most definite facts in biology. Indirectly, at least, the statement may be applied to all the vitamines in so far as the action of one is dependent on the proportion of the others present in the body tissues. This inter-relationship has recently been demonstrated to exist to such a degree that the question has been raised as to whether the effects attributed to individual vitamines are not really the result of all of them acting in combination. However, this is another problem, apart from our present purpose.

The point is that the investigation into the behavior of vitamines has given us considerable information as to the nature of the response to light rays, although we would not be understood as limiting the effects of the Dorno-rays to vitamin activation. A mere increase in vitamine will not serve to explain all of the effects of the Dorno-rays and it is our opinion that much injury has been done to the use of these rays because of the general acceptance of this impression.

The discovery of this association, however, gave impetus to the investigation of the relationship of irradiation to calcium and phosphorus metabolism and introduced a means of checking the action of such irradiation in a bio-chemical way. From these observations, as well as the evidence accumulated on the effects of the Dorno-rays on the glands of internal secretion, immunity reactions, the nervous system, the blood elements, renal function, and digestive action, we have a sound foundation on which to base our clinical studies, and consequently we can draw certain conclusions as to the manner in which individual cases respond to treatment and determine to some degree what constitutes an adequate course of treatment.

So far as our investigations go, no definite, experimental work has been done to determine the minimum exposure time necessary to secure the full, anti-rachitic effect. In regard to the effect on the bactericidal property of the blood and its relation to the exposure intensity, the National Institute of Research, in England, found that the maximum effect followed an exposure sufficient to produce a second degree erythema or, expressed in erythema reaction units, one and a half times the exposure necessary to produce a first degree erythema. A radiation in excess of this was sometimes found to be followed by a fall in the bactericidal titre of the blood. Assuming that the other effects correspond to this, we have here at least some definite basis for determining exposure time, other than skin tolerance. In actual practice, we make it a rule, partly in consideration of the patient's comfort, to begin treatment with one-half to two-thirds of this dosage; that is, a little more or less than one erythema unit, depending on the type of patient, and then gradually increasing the dose according to the clinical response of the patient until a maximum of five to eight erythema units is reached.

As an indication of untoward effect from a too rapid increase in dosage, we consider insomnia as the most characteristic and most frequent symptom of over dosage. We had this rather forcibly brought to our attention a few years ago by the experience of a well patronized solarium of an Athletic Club in an eastern city. Shortly after the installation had been made, we received a letter stating that the members were most enthusiastic about their light baths and the invigoration they received from them, but many were complaining that they slept poorly after their irradiations. It was quite apparent that in their enthusiasm to hastily acquire a winter coat of tan, they had been inclined to overdo the treatment.

Failure to show clinical improvement is also likely to be more an indication of over-dosage than under treatment, although failure to take into consideration other factors, such as proper rest and elimination, will account for some lack of results.

The occurrence of focal reactions is also an indication for caution although, as we have pointed out in a previous paper, it does not constitute a contra-indication.

We do not wish to impose upon your patience too much by a detailed discussion of all the elements that influence the frequency with which treatments are prescribed and the duration of the course of treatment. Were this simply a matter of giving treatments as often and as long as the patient will stand for it, we would need to give little concern to the question. Any therapeutic measure, of course,

may be abused in this respect. Because of the absence of immediate, visible effects, and because of the fact that people in general are accustomed to thinking of radiant energy as very simple and limited in its action, there is a natural tendency to minimize the results of a single irradiation and, as a consequence, there may be an inclination to repeat the treatments too frequently and over too long a period even with the best of intentions.

Our impression has been that the greatest clinical response usually follows after the first four or five treatments, given every other day. Sometimes, we see a most striking improvement even after the first irradiation. When such immediate improvement follows, the effect of treatments subsequent to the first week or ten days is more to sustain the reaction induced by the initial series than it is to add to such reaction. There are, to be sure, instances of such marked depletion and lowered vitality that improvement does not appear in the early course of treatment. Even in these cases, nothing is to be gained by crowding the treatment. If sufficient attention is given to other measures, the response to light radiations will be found to improve along with the restoration to normal function in other respects.

Where the condition is largely that of a nutritional disorder for which the Dorno-rays are specifically indicated and where there are no other disease processes militating against the action of the rays, we may expect a maximum and lasting response in a period of a week or ten day course of treatment. It may take continued treatment to maintain this improvement but, on the other hand, we have seen numerous cases with decided and chronic symptoms make a complete and lasting recovery without more than a week or ten days of treatment; and we have seen others that showed a considerable amelioration of their symptoms after the first few treatments but who failed to show continued improvement with more prolonged treatment. These clinical observations are supported by the results of blood chemistry studies made of patients receiving light treatment. Such studies show that a blood calcium and phosphorus deficiency is converted to a normal figure in ten to fourteen days of Dorno-ray treatment. Taking all these clinical and experimental observations into consideration, our experience has been that a prolonged and positive result can be secured by a course of ten treatments, extending over a period of three to four weeks. In some cases, particularly the tuberculous, it may be advisable to extend the period of treatment beyond this until the condition remains stationary for some time. The treatment may then be interrupted until evidence of relapse occurs.

It must not be forgotten that many diseases are characterized by spontaneous remissions and reoccurrences regardless of what measures are employed. A case is not cured simply because of cessation of symptoms. Treatment may be interrupted during remissions and hence it is therefore advisable to be on the alert for relapses. We prefer to treat at two day intervals rather than daily because we have never seen any advantage in the latter, and there are some reasons for believing that there is more "shock effect" by allowing more time for each reaction to subside.

To summarize the results of our clinical experience with the Dorno-rays and the deductions that can be drawn from laboratory experiments with these frequencies and the analogies that can be drawn from studies of vitamine activity, we may briefly state the following principles:

1. The amount of irradiation at each treatment is determined by the character of the clinical response to one erythema unit of radiation and subsequent increases rather than by the degree of skin reaction in the individual subject.

2. In the absence of insomnia, lack of clinical improvement, and severe focal reactions, the intensity of radiation can be increased gradually to a maximum of five to eight erythema units.

3. Two to three days should elapse between exposures.

4. In cases that react well, four to five irradiations may suffice to bring about a restoration to normal intermediate metabolism.

5. Most cases with symptoms of vitamin deficiency and suboxidation become stationary after a month of treatment in so far as their response to ultraviolet radiation is concerned, and for practical purposes, treatment may be interrupted then until indications of a relapse appear.

In view of the great variety of diseases in which the energizing action of the Dorno-rays is indicated, it may appear as though we are assuming a rather arbitrary position in recommending a set of rules that will apply to

their use in all cases. These rules, however, are flexible enough in their application to permit considerable latitude in individual cases. While they do not definitely answer the question as to what constitutes an adequate course of treatment under all circumstances, they at least serve as an attempt to interpret the relationship between the physiological effects and the amount of irradiation that is prescribed. Our purpose has not been to lay down a fixed technic that can be applied in a routine way to any and every condition in which the Dorno-rays may have a favorable influence but, rather, to point out certain features in the nature of the response of the human organism to these rays by which the operator can intelligently direct the course of treatment regardless of the nature of the disease.

These considerations are most pertinent in the management of those cases in which the treatment is carried out for the purpose of bringing about an improved nutrition and general functional vigor. In hay-fever and asthma and other similar forms of hypersensitization such as *dermatitis veneneta* it is probable that the inflammatory reaction in the skin plays an important part in the beneficial results that follow. In these diseases, it is our impression that better results are obtained by laying down a fairly intense erythema at the first or second radiation to the maximum degree the patient will tolerate. The same thing applies to such dyscrasias as *eczema* and *psoriasis.*

In conclusion, we wish to add that we have omitted for the sake of brevity to include in this discussion a detailed description of cases and experimental data on which these opinions are based. We feel, however, that the experience of others who may be better situated to investigate these problems, will be necessary to prove the correctness of our deductions. If we have succeeded in calling attention to the need that exists for more definite standards of treatment, our purpose will have been accomplished.

THE COMBINED USE OF RADIUM AND SURGERY IN THE TREATMENT OF CARCINOMA OF THE FACE *

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Malignant growths of the face are divided into two main groups, the basal cell and the squamous cell epitheliomas. The epitheliomas located above the angle of the mouth are usually of the basal cell type, while those below the angle of the mouth are the squamous cell. Growths on the ear may be exceptions to this rule because they are more often of squamous cell type.

This makes the epitheliomas of the ear as much to be feared as those of the lower lip because, although they do not metastasize early to the glands of the neck as do those of the lower lip, they may invade the cartilage of the auricle or the canal; and once they reach the canal they are usually incurable.

The basal cell type of epithelioma when it does not invade cartilage, may be cured by x-ray or radium or electrocoagulation or the scalpel. With these growths, the type of radiation, either x-ray or radium, matters little. Usually that form is used which is easier of application, and for small growths radium is generally better. Radiation may be preferred in treating the malignant ulcer of the eyelids or upper cheek because excision might leave a scar that would contract and produce an ectropion, to relieve which a plastic operation would be necessary. However, I can recite an experience of a patient who had an epithelioma of the inner canthus that was treated first by x-ray and then by radium for a recurrence. When a second recurrence of the ulcer appeared I removed it with the Bovie cautery which produced a perfect result.

Epitheliomas of the ear and nose have one feature in common, and that is, they have very little distance to go before they encounter cartilage. Once the cartilage is involved, radiation is not sufficient to effect a cure. On the other hand, growths in these two localities differ in that those on the ear are usually of the squamous type, while those of the nose are of the basal cell type. Therefore, the latter may be temporized with longer than the former.

An ulcer of long standing must be regarded with suspicion, and the suspicion of malig-

* Read at the Ninth Annual Meeting, American Congress of Physical Therapy, St. Louis, Mo., Sept. 9, 1930.

nancy must not be relinquished unless proven otherwise by examination. When in addition to a history of long chronicity there is found present a sluggish base to the ulcer and an edge that is firm and thickened and probably fixed, then the suspicions are almost confirmed. The patient may, however, further cloud the diagnosis by informing the physician of the existence of a chancre some years ago. The doctor will take a specimen of blood for a Wassermann test and the report comes back positive for syphilis. Then the question arises, what shall be the line of treatment? Personally, I have at present one case of epithelioma of the ear, one of the lower lip and one of the throat that were treated for syphilis because the Wassermann test was positive. The absolute diagnosis was made twenty-four hours after the removal of a piece of tissue and examined by the microscope. I maintain that the luetic treatment of a malignant growth can be avoided by a biopsy and, furthermore, that if such a growth does not improve in three or four weeks under antisyphilitic treatment, such treatment must be stopped forthwith.

Now, having made the diagnosis of epithelioma of the ear, what is the best form of treatment? Radiation can be used with success if the cartilage has not become invaded and should be discontinued as soon as the healing comes to a standstill. At this stage, excision must be relied upon, just as in the first place when the cartilage is involved and surgery should have the preference over radiation. Excision should, as a rule, include the whole auricle, though, at times, the malignancy may be given a margin wide enough so that one is not risking a recurrence.

I have two examples in mind of what can happen when radiation is persisted in during non-healing or recurrence. Either the malignant cells become resistant and are no longer affected by the radiation, or damage is done to the surrounding tissue so that repair cannot take place. Under such conditions a wide excision with some form of plastic to repair the defect must be resorted to. These excisions must always be larger than if done before the surrounding tissue had been devitalized.

Therefore, it is well to urge you not to continue treatments with radiation when you are not getting results. Either the dosage has been too small or the tissue has been destroyed.

Epitheliomas of the lower lip are the most to be dreaded of all growths of the face because they metastasize early to the glands of the neck. Like almost all other malignant ulcers or epidermoid growths, the history is one of long standing. There undoubtedly was a time at the beginning when the growth was a benign chronic ulcer. At that time, an application of 25-50 mg. of radium, with 1 mm. aluminum filter or in bare steel needles for fifteen minutes contact, would have probably healed the ulcer. Or a simple excision would have cured it and no treatment to the glands of the neck would have been required. But when that stage has been neglected by the patient or allowed to pass by poor or dilatory medical advice, then radiation and surgery must be resorted to. It must be very rare that the local growth cannot be cured by radium applied on the surface or inserted in the form of needles or emanation. X-ray and radium must next be applied to the glands of the neck whether they are palpable or not. If they are palpable I wait six to eight weeks after the last radiation treatment and then do a block dissection of all the glands of the neck on one side, or bilateral if the lesion was close to the midline.

If excision is delayed until the glands break down it will be too late. I am further convinced that x-ray, alone, will not destroy carcinoma cells in the cervical glands from an epithelioma of the lip.

Conclusions

It is my impression that basal cell epithelioma of the soft tissues of the face may be cured by x-ray, radium, electro-coagulation, or excision.

Epithelioma of eyelids, ear and nose, when involving the cartilage, suggests the question of urgent excision.

Epitheliomas of the lower lip require radiation of the lip and glands of the neck, with block dissection of the latter before they have had chance to break down.

A biopsy is better than a Wassermann report for diagnosis.

Too much radiation may be as bad as no treatment at all.

"THE BEHAVIOR OF LIVING TISSUE IN VITRO AND THE EFFECT OF RADIUM UPON CANCER CELLS, R. G. CANTI, (London)." *

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The showing of the Canti film in St. Louis has been made possible through the purchase of a copy of the original film by the St. Louis Committee of the American Society for the Control of Cancer of which Dr. Ellis Fischel is Chairman. The local committee obtained it from the American Society.

Work on the effect of irradiation upon tissue cells both *in vivo* and *in vitro* has been carried out at the Strangeway's Research Hospital in Cambridge and St. Bartholomew's Hospital in London, for some years past. Dr. R. G. Canti of London, has continued this work since the death of Dr. Strangeway.

By means of the cinematograph it is possible to obtain records over a long period of time, records which can be re-examined on as many occasions as it may be required for their interpretation. Canti's setup was very elaborate. It is described in an original article.[1] Similar work has been done in this country and a much less elaborate setup has been devised which shows the development of growing human tissues in the test tube. Great advances should thus be made in the study of not only malignancy, but other generalized pathological conditions.[2]

To study the effect of irradiation upon normal tissues, these workers used periosteum of the chick embryo of 6-8 days incubation, or freshly prepared and placed *in situ* for photographing. The medium for this explant was fowl plasma and chick embyro extract. For the study of malignant tissue, portions of tumors of Jensen's rat sarcoma of the 2nd to 5th subculture, placed in fowl plasma and serum of the tumor bearing rat, were used.

To study the effects of irradiation upon these cultures, they used radium emanation contained in small glass tubes. The strength varied from 70 to 150 millicuries, at a distance from 4 to 7 mm. Distance is a factor in filtration, the *beta* and *gamma* rays exerting their action at a greater distance than the *alpha* rays. This fact is made use of in practice when radiating hemangiomas or tuberculous adenities with the radium salt. Canti's cultures received a heavy dose of both *beta* and *gamma* rays in that emanation was used.

Photographs were taken at intervals of 3-10-30-60 seconds, and with the resultant picture shown at the usual speed of 16 per second a respective speeding up effect of 50-120-480-960 times is obtained.

Thus, in a few minutes we can observe the growth of a cell which under actual conditions requires weeks of observation. The ease of observing the finer structure within the cell is apparent as some of the magnifications are 78,000 diameters when the film is projected on the screen.

In this film is seen growth of normal cells, malignant cells, growth and degenerative changes in older cultures, as well as changes due to irradiation of normal and malignant cells. In this way one can differentiate clearly changes purely as result of irradiation and compare them with changes due to ageing of the culture or degeneration.

The action of irradiation in the intensity used in these experiments brings out the point that fibroblasts of normal periosteum appear to show very little change as a result of exposure to the amount of emanation used. The wandering cells are markedly effected after 20 minutes. When the cells of the Jensen rat sarcoma are subjected to the same amount of irradiation apparently the whole of them are effected in about the same time as the wandering cells of the normal tissue.

It would, therefore, appear that the hypothesis of the selective action of irradiation on the cells of a malignant tumor has been substantiated by this method of direct observation.

The irradiation of malignant tissue has its beginning about 1905, at which time both the

***(A motion picture film loaned by the American Society for the Control of Cancer, St. Louis, Committee.)**

* Presented before the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, September, 1930.

gamma and *beta* rays were allowed to act. Severe burns were the result in this early treatment, and it was not until 1907 that Dominici conceived the idea of using the filtered ray. Since that time clinicians have used different forms of filtration, depending upon the type of radiation most desired. Substances used for filters have been brass, silver, aluminum, gold, glass, lead and rubber. The idea in filtration is to remove the *alpha* and some of the *beta* rays, thus allowing the action of *gamma* rays mainly.

The Canti film demonstrates the mode of action of the *beta* and *gamma* rays. In that radium emanation in which glass seeds were used, the ray was more a pure *gamma* type. Previous to this time Canti and Donaldson had observed the action of these rays on various pieces of malignant tissue, which had been removed on successive days following an irradiation which lasted 24 hours. They had observed that immediately after the irradiation and sometimes during the irradiation mitosis disappeared, but that it reappeared later in greater number, reaching a maximum about the fourth day after treatment had ceased. These mitoses were abnormal in type, but cell debris did not appear until after the sixth day, and if sufficient radiation had been applied no malignant cells could be found in the area five or six weeks following. This work was done on cases of carcinoma of the cervix and more or less lead up to the observations on irradiation of tissue cultures. In the irradiation of tissue cultures, such as Canti has carried out, the effect is practically the result of a direct action on the cancer cell, in that these cells are in a stagnant environment.

The film shows that mitoses cease soon after the radium is applied, providing a sufficient dosage is used. If the radium is removed three or four hours following its application, mitoses returns and again some of this is abnormal in character. That the fibroblast of the normal tissue is not effected so readily is interesting, and, perhaps, the reason for the lessened resistance of the sarcoma cells is due to their more active state of metabolism. Clinically we find that not only are malignant tumors in this category, but we will have to include ovaries, testes, etc., as being less resistant than the more stable or less active tissue. In regard to the indirect action of the rays, there are both experimental and clinical observations which tend to substantiate the idea. Caldwell and Russ[3] have shown that breaking down tumors, destroyed by irradiation or other means, were capable of producing immunity as evidenced by a failure of reinoculation of a similar tumor.

There are a number of clinical reports that the irradiation of a primary growth has an effect on secondary growths. On account of close proximity of secondary to primary growths in a majority of these cases, I think it is more significant that upon the irradiation of a benign tumor, such as a *verruca* on one part of the body, a *verruca* greatly distant from the one irradiated will disappear.

In Canti and Donaldson's studies [4] it was not so apparent that there is a marked difference in radiosensitivity of different tumors. Clinically this has been observed and Ewing has classified tumors in regard to sensitivity based upon their cytology.[5] The main factor to consider is that of anaplasia, and shows the more anaplastic or undifferentiated tumor to be more sensitive. Of course, all tumors are made up of cells in different stages of growth phase, but the percentage preponderance of cells in a certain period of the phase is different in some tumors than others. The anaplastic or undifferentiated tumor is made up of cells in the early part of the growth phase, and this can be compared to the sarcoma as it is growing in the tissue culture, as these cells are of a more embryonic type. Clinically it is the least resistant to radiation, but it is also the most malignant type of tumor. On the other hand, the tumor which has more of the mature cell in its makeup is more resistant to radiation and is less malignant.

Broders [6] has developed this idea to the stage that he classifies the tumors on the basis of cell differentiation in the four groups, and by taking into consideration absence or presence of metastasis and the area involved he has given us a means of ascertaining prognosis to a better advantage. Furthermore, this has given us another means in determining the method of treatment in a particular case.

The time of the effect of radiation on the basis of Canti's work, previous to the making of this film, as well as the work shown in the film itself, is an interesting one to consider. Clinically, the effects of irradiation, regardless of type, (in this may be included x-radiation as well as *beta* and *gamma* radiation), do not manifest themselves until a number of days following the application. The reason for this

may be seen when we consider the primary radiation as mainly an arrest of mitosis or cell growth and the secondary irradiation as a tissue destruction.

In biological studies Ernst and I [7] have shown there are two forms of substance in tumor tissue. These are present in normal tissue, but not in the same proportion. Malignant tissue is high in a water soluble substance, which is a cell growth stimulus. This stimulus is necessary for the life of the cell. Probably the immediate effect of irradiation as shown by Canti is due to a change of this substance. Its dialysability may account for the regained vitality of the cells following the lesser amount or period of radiation.

In the human, one would consider the important radium effect as being due to a change of a more stable element, the fat soluble elements. This is the second substance we have found in the tissue culture of malignant tissue. This would account for the longer latent period of radiation effect.

Another thing to consider is that of penetration and quantity of radiation. On account of practically direct contact to the cell, as was possible in Canti's setup, the absorption of radium may have been enough to cause an immediate destruction of the fat soluble elements. One can assume this from the behavior of the cells which extrude their protoplasm. In radiating a block of human tissue with a current of blood passing through, one has a different state of affairs than in the stagnant culture media, and probably the greater part of the effect of radium on a tumor in the living is due to secondary rays which are being liberated gradually from the tissue with which the radium was placed in contact.*

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* Discussion of this paper will be included in a succeeding issue.

THE PHYSICAL NATURE OF DEATH *

GEORGE W. CRILE, M.D., MARIE TELKES, Ph.D., and AMY F. ROWLAND, M.A.

The terms "living" and "non-living" and "dead" denote variations in energy and form. In structure the living organism is identical with the non-living—just as the live battery is identical in structure with the dead battery. But what is the essential feature in the living organism upon which structure depends? What is lost in death?

Thirty-five years ago I first attempted to approach this problem by an investigation of the basis of death. Phenomenon after phenomenon associated with death was critically examined and set aside as it was found to be a result rather than a final cause of death.

Studies of the circulation and respiration showed that the changes in these vital phenomena which are present in exhaustion and death are end effects and not primary causes of death. So, too, studies of the chemistry of the blood, while they revealed that the acid-alkali balance of the organism is of vital significance, did not reveal the cause of death.

Resuscitation experiments were performed in which it was found that in normal animals after complete cessation of the circulation for from five to seven and a half minutes, resuscitation followed the infusion of adrenalin into an artery; in the course of these experiments the sequence in the return of the various functions and reflexes was observed. But these experiments, important as they were, did not reveal the cause of the cessation of circulation and of the final death which would have followed had not the dose of adrenalin been administered.

By the examination of great numbers of cells under the microscope we found that certain histologic changes were invariably present in the cells of the brain and of the liver after death from any but sudden and accidental causes. The nuclear-cytoplasmic relation was disturbed and the semipermeable membranes were in process of disintegration. That life was incompatible with such a condition of the cells was obvious but was the condition of the cells in itself the actual immediate cause of death?

Later we directed our investigation to the determination of certain physical constants in various vital and lethal conditions. We found that the processes leading to death were always accompanied by a decrease in the conductivity of the brain and of other components of the central nervous system, and by an increase in the conductivity of the liver with corresponding changes in the electric capacity of the cells. But certainly a change in the conductivity and capacity could not be the immediate cause of death.

Death may result from many diverse causes: from hemorrhage, from physical injury, from infection, from insomnia (Figure 1), from anesthesia, from asphyxia, from surgical shock, from the excision of certain organs—any of these agents alone may produce death, or death may be due to a combination of any of these different factors. Thus in war a soldier may die not as the result of wound alone, or infection alone, or insomnia alone, or anesthesia alone but as the result of a combination of all these various factors. But whatever the cause of death the phenomena of death are identical.

In death the energy characteristic of life is lost—the dead body is in equilibrium. In death the living structures, namely, the cells, are unable to hold their form and structure and inevitably disintegrate. In death the delicate organic molecules such as the fatty-acid chains lose an organizing, binding influence and they too disintegrate.

We propose now to offer new experimental evidence which identifies a form of energy that is lost in death—a form that is capable of constructing the films and of holding together the essential organic molecules.

These researches which have been carried out in the research laboratories of the Cleveland Clinic Foundation were directed toward finding the relation between electrical potential and oxidation; that is, toward determining whether one or the other is the primary factor in the maintenance of life and whether the loss of one or the other is the essential factor in the production of death or whether both together are primarily essential. Our re-

* Presented before the American Philosophical Society and reprinted by permission, from the *Proceedings* of that society, which was founded 1727 by Benjamin Franklin.

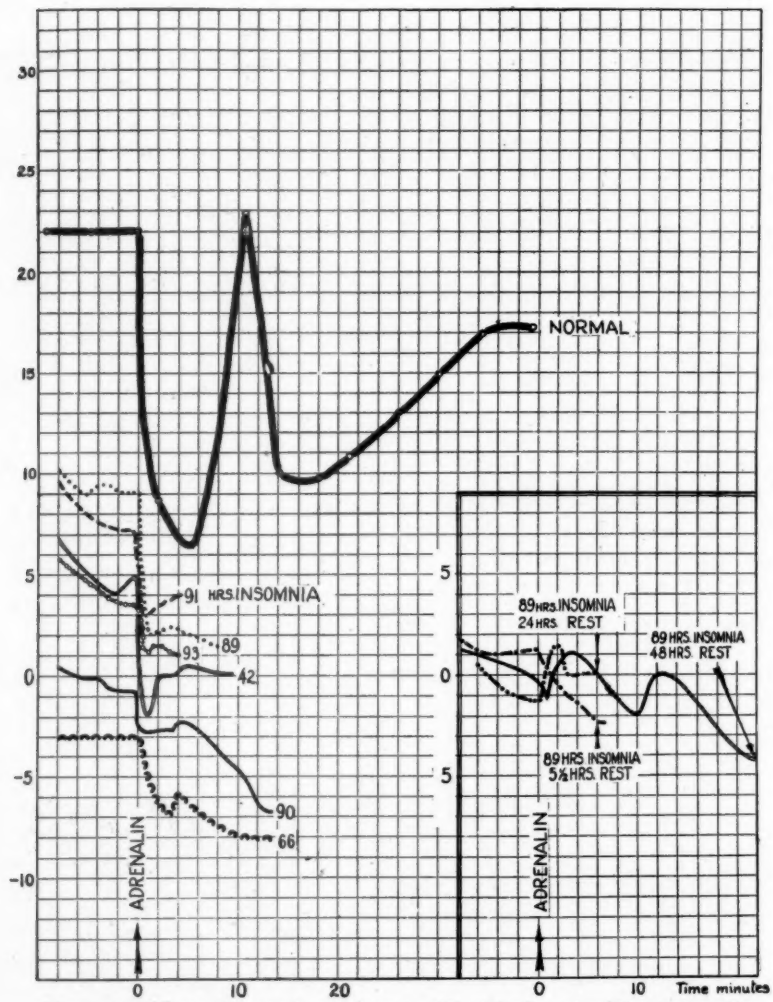

Figure 1. Effect of insomnia on the potential of brains of rabbits. Note diminished response to adrenalin in the insomnia rabbits. (Time in minutes)

searches were especially directed toward the discovery of the influence of potential on oxidation; the influence of potential on the form of the living, and by inference on the maintenance of the organic molecules; and to the discovery of the relation of the potential to death.

The results of these researches may be summarized as follows:

1. In animals, plants, and fruits an electric potential exists during life and disappears at death. (Figure 2.)

2. The potential is varied by insomnia, by anesthetics, by poisons, by hemorrhage, by asphyxia, by change in electrolytic solution, by adrenalin, by injury, by heat, and by cold.

3. At the moment of clinical death the potential difference between different organs drops to zero for a few moments; following this, each organ regains its potential for a short time, but finally the potential of all tissues drops to zero, the respiration of the tissues stops, and molecular disintegration sets in.

Are we then correct in ascribing the cause of clinical death to the fall in the potential between the different tissues, and the cause of the death of single cells or of tissue cultures to the fall in the potential on the cell membrane?

Of primary importance was our finding that insomnia by itself alone produces a progressive loss of potential. In our experiments, if insomnia was sufficiently protracted, the potential declined to zero and the animal died. As the potential approached zero, re-

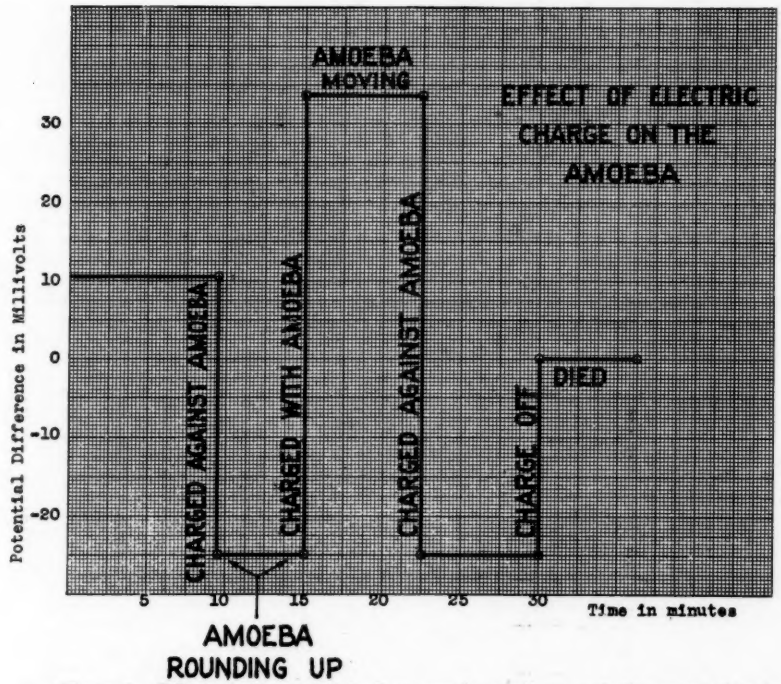

Figure 2. Effect on the potential of an amoeba of direct and of counter electric charges.

covery of potential followed a sufficiently prolonged period of sleep and of rest. Of special significance was the fact that after prolonged insomnia the animal did not respond in normal fashion to the injection of adrenalin. (Figure 1.)

If the molecular structure depends upon an electric strain or potential which also enables the organism to function and grow, we must find direct evidence therefor. Happily we found such direct evidence in observations of the potential of an amoeba. Dr. Telkes designed and constructed an electrode which could be inserted into an amoeba and with this electrode she made measurements of its potential She found that the potential of the amoeba ranges as high as 15 millivolts and that it changes with alterations in the concentration of the electrolytic solution in which it is immersed, with changes in temperature, and when anesthetics are added to the suspending solution. Radiation, adrenalin, and sodium iodide all induce characteristic changes comparable to those seen in rabbits and in dogs.

The amoeba was observed under the microscope during the experiments. Here we had our first opportunity of noting under the eye the changes in structure which are produced

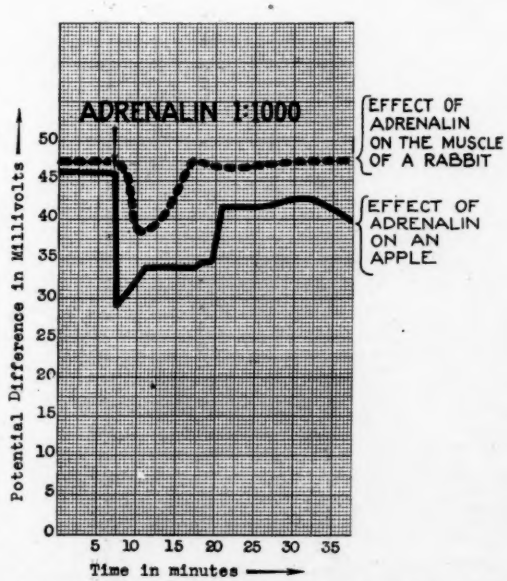

Figure 3. Effect of adrenalin on the potential of muscle of rabbit (animal) and on potential of an apple (fruit); that is, effect was same.

by these various agents. Of special interest and importance were the effects of changes in potential produced by the direct application of an electric charge which could be varied at will. When the charge was increased the potential rose, and the amoeba became more ac-

tive. On the other hand when the potential was diminished by introducing a current the direction of which was opposed to that in the amoeba, the amoeba progressively became less active and withdrew its pseudopodia; that is, it rounded up into a quiescent lump, until when the potential reached zero or went over to the negative side the amoeba disintegrated first into larger then into smaller granules and fragments and finally disappeared in the suspending solution. When, however, the potential was lowered by the counter-charge, and by no other factor, nearly to zero and was held there, the amoeba would round up and some granules might even disintegrate; but if at that crucial point when death and disintegration were imminent, the potential was raised by increasing the charge and by nothing else, the amoeba would pass from the resting to the active state, and would again throw out its pseudopodia. (Figure 2.)

This crucial experiment indicates that the fundamental control of the molecular integrity and of the activity of the amoeba—this differ-

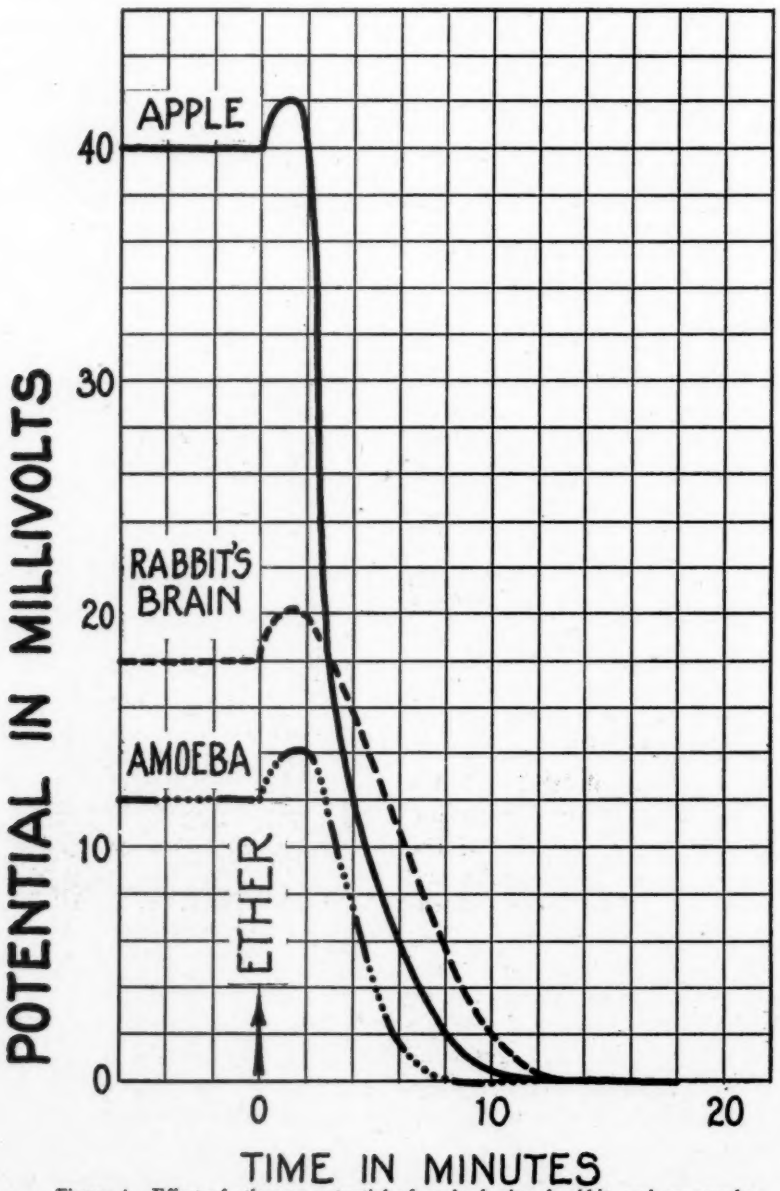

Figure 4. Effect of ether on potential of apple, brain of rabbit, and an amoeba—again, same effect.

ence between life and activity and death and dissolution—is governed by the change in the electric potential. In our experiments activity, quiescence, death, and dissolution were governed completely by the production of variations in the potential alone.

From this we may infer that the organic molecules that are bound together in the animal organism, the arrangement of crystalloids and colloids, the separation of nucleus and cytoplasm, the maintenance of the molecular organization—we may infer that all these phenomena are manifestations of electric force. Electrical potential is the product of chemical activity and in turn the electrical potential governs chemical activity. These electrical and chemical processes are the governing factors in the production of the phenomena which are characteristic of life. In their absence the organism is dead.

If the organic compounds, structures, and so on, in plants and in animals are created by electric potential and chemical activity, especially by oxidation, then in such intermediate forms of life as fruit the same law should hold.

We therefore extended our researches to an investigation of the phenomena of potential and of oxidation in fruit and we found that every kind of fruit has a potential—the potential of an apple, for example, is about 50 millivolts, and the apple has also a steady respiration—consuming from three to four cubic centimeters of oxygen every hour.

In our experiments we found that the potential and the respiration of the apple change in the same direction under the influence of anesthetics, and of changes in electrolytic concentration. The administration of adrenalin, changes in temperature, and the exclusion of

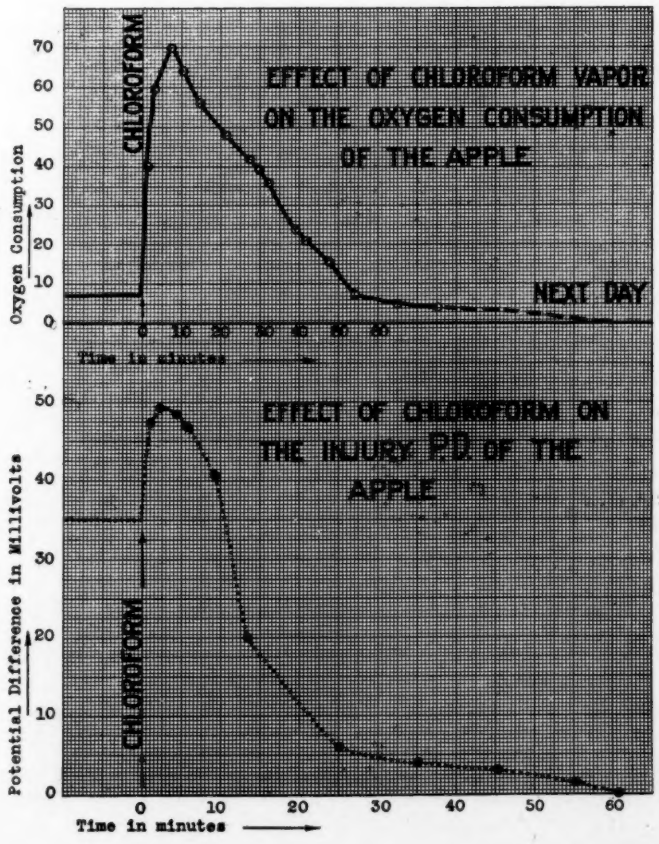

Figure 5. How chloroform affected the potential difference of apples—again an initial rise, followed by a steady drop to zero.

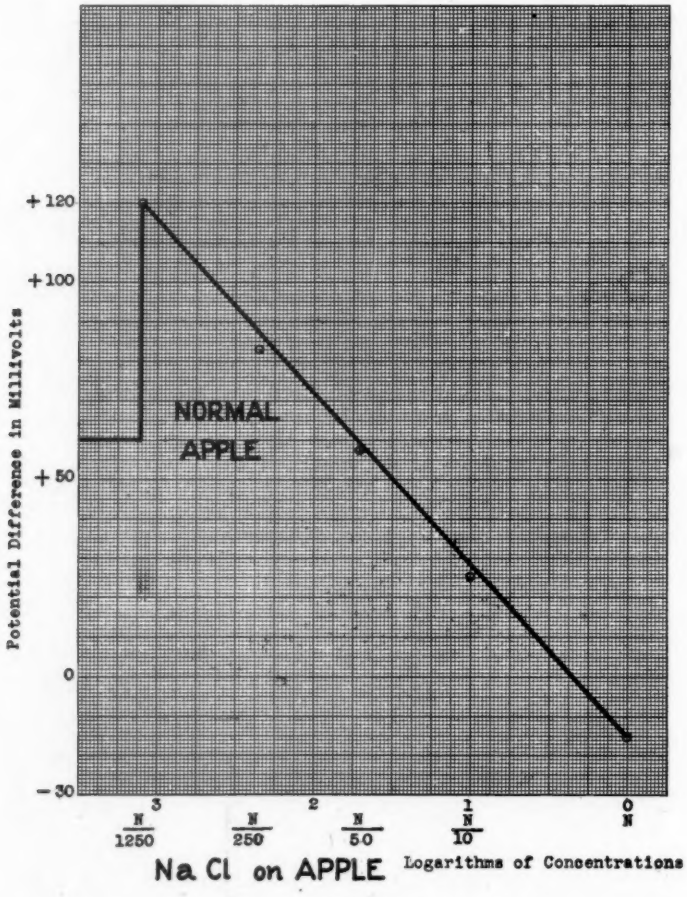

Figure 6. Logarithmic curve showing effect of varying concentrations of sodium chloride on the potential of a normal apple. The circles represent the five observed values.

oxygen affected the apple just as they affect the rabbit and the dog. (Figure 3.) Anesthetics caused first an "excitant" stage which was indicated by a rise in potential and an increased metabolism; that was followed by a continuous fall of both the potential and the metabolism to the zero point, after which neither potential nor metabolism was again manifested. (Figures 4 and 5.) Adrenalin caused a fall in potential followed by a rise and the respiration of the apple was increased. Changes in electrolytic solutions caused changes in potential which were in conformity with the Nernst formula. (Figure 6.) When the electrolytic concentration equaled the concentration of the electrolytes in the apple the potential fell to zero. Immersing the apple in oil caused the potential and respiration to fall to zero and to remain there. Increasing the temperature of the apple caused the potential and respiration to rise together and after an irregular fluctuation at a given height both fell to zero and remained there.

In all cases in which the potential was reduced to zero the apple disintegrated, just as animals and plants and the amoeba disintegrate when their potential is reduced to zero. A battery was constructed by arranging halves of apples in series and a potential of over a volt was thus created. (Figure 7.)

By this study we have demonstrated that the structure of the apple, like that of the amoeba, is dependent on potential and here again we saw the relation between electric strain and the maintenance of the organic structure.

If oxidation is due to a difference of potential and if living cells are concentration cells,

then if apple juice were placed on one side of a celluloid film and distilled water on the other, oxidation and potential should be manifested just as in the apple, amoeba, or rabbit. Such an arrangement was made and as a control another artificial "concentration cell" was set up which was identical with the first, except that a hole was punched in the celluloid film in the control cell. Observations of metabolism and of potential showed that the first artificial cell functioned like the apple and the amoeba; that is, it had a potential and it showed respiration; the control cell, on the other hand, had neither oxidation nor potential.

In brief, then, in a large series of experiments we have found that in animals and in plants and in fruits there exists a potential which has a certain range during life and dispears at death. This potential is dependent on the presence of a semi-permeable film, on certain electrolytic concentrations, on water, on temperature, on oxidation, all of which together create the organizing potential. It is the charge on the films of the cells which endows the organism with its selective or adaptive property; oxidation occurs only in the presence of an electric charge and the charge is created by oxidation. Life is a phase of the organization created by electric strain or potential and death is an inert stage in which potential is lost and disintegration is inaugurated.

Or we may define life and death in the following terms: Life may be defined as a potential which is maintained and is varied adaptively according to environmental conditions, this potential being maintained by chemical activity—mainly by oxidation. The loss of this potential is death. The principal

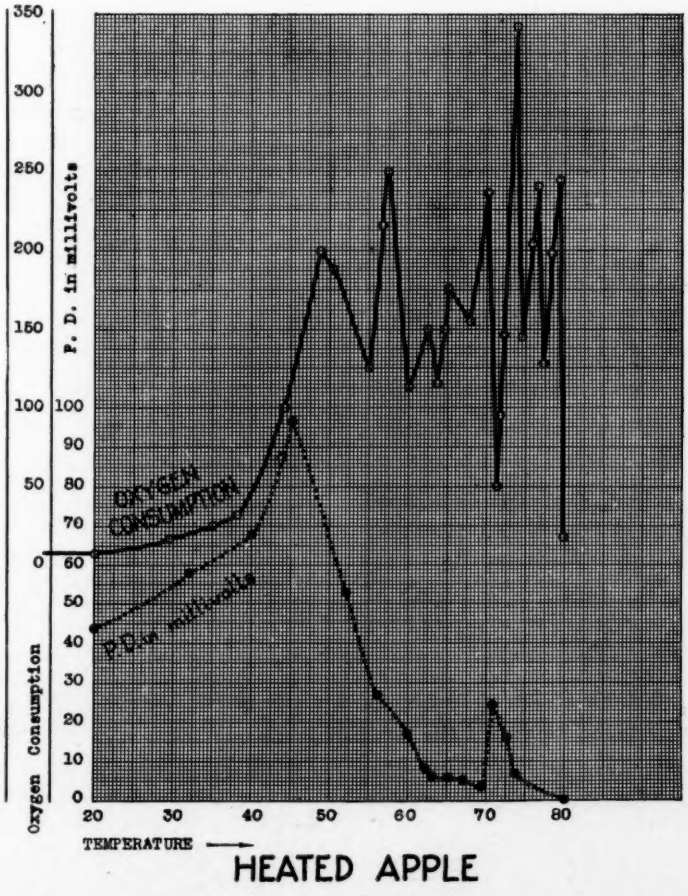

Figure 7. The apple "battery" made of 50 halves of apples arranged in series. Its potential was more than one volt. The halved apples are piled up in series and electrodes are attached to the bottom and top halves, respectively.

difference, then, between that potential which is life and the potential which is present in non-living systems like concentration cells is that the living potential is spontaneously and adaptively alterable.

In brief, then, life in the unicellular organism is an adaptively changing difference in potential between the cytoplasm and the medium in which it exists, and presumably between the cytoplasm and the nucleus. In the lowest forms of multi-cellular organisms life is an adaptive difference in potential between the central nervous system and the rest of the organism; in the higher multicellular organisms life is an adaptive difference in potential between the brain and the other organs and tissues, especially the liver. The life of an organ or tissue depends upon the maintenance of a difference of potential between the cells and the intercellular medium, and presumably between the nucleus and the cytoplasm of the individual cells of which it is composed. And in the unicellular and in multicellular organisms alike death is the absence of a difference of potential—final equilibrium.

NEW APPARATUS

A New, Automatic Invention for the Removal of Gas and Residue from the Colon

This scientific apparatus stimulates the physiological action of the colon. It is the first device designed that automatically releases gas encountered in the intestines during the passage of the cecum tube, thus giving instant relief to the patient and overcoming one of the greatest difficulties experienced by technicians. A syphonic action, having an approximate three-pound pull of only one second's duration, prevents injury to the intestinal mucosa, while the quick withdrawal of gas and residue out of the colon, avoids injurious abdominal distention.

The illustration herewith (Figure 1) shows in detail, the latest portable model of the new Schellberg Automatic Gas and Residue Release Accelerator. This apparatus (invented by O. Boto Schellberg) can be taken apart and reassembled in a few minutes, and in its entirety, weighs only five and one-half pounds; it is compact and can be carried in a grip.

Figure 1

QUERIES AND CLINICAL NOTES

Q. What is the value of ultraviolet therapy in Pediatrics aside from its recognized specificity in rickets?

A. It is indeed extremely difficult to reply to a question so broad as this. The answer must necessarily also be broad, but for lack of space only a summary can be given. The questioner is referred to an article by Tisdall which appeared in the *Canadian Medical Association Journal,* June, 1927. Tisdall covers the subject in some detail and then concludes: "Ultraviolet therapy by means of the ordinary air-cooled mercury vapor quartz lamp is an absolute specific in the treatment of rickets and tetany. Definitely beneficial results are obtained in the treatment of abdominal, mediastinal and glandular tuberculosis. The results are questionable with bone, joint and pulmonary tuberculosis. Chronic non-tubercular cervical adenitis responds well to ultraviolet therapy. In the opinion of unbiased observers, ultraviolet therapy may be a useful adjunct in the treatment of the following conditions: Psoriasis, chronic eczema, furunculosis, seborrheic dermatitis, alopecia areata, purpura, coeliac disease and malnutrition. It should be stated, however, that in most instances it can be replaced by more simple forms of therapy." Its tonic effect is now universally acclaimed. It is therefore of value in the majority of convalescent states, secondary anemias, low appetite, poor nutrition and nervousness.

Q. What success has been had with ultraviolet therapy of Angina Pectoris?

A. There has been no extensive clinical investigations along these lines and only scant references are to be found in the literature. An article which appeared in the *Wiener klinische Wochenschrift,* June 21, 1928, was abstracted as follows in the *J. A. M. A.*: "During the past two years Freund has been using the quartz lamp in treating cases of angina pectoris. In this treatment a great deal depends on the technic of administration. This is given in detail. In the first twenty-two cases treated, a regular control of the blood pressure was carried out. In seven cases the blood pressure dropped definitely, in ten cases it remained unchanged, and in one case it rose. Modifications of the blood pressure, however, seemed to have no effect on the improvement of the patient's condition. Even the etiology of the patient's disease seemed inconsequential. Thus two cases of syphilitic aortitis in young individuals reacted very satisfactorily, as did also a case of contracted kidney with high blood pressure. The favorable psychic effect of this treatment on the patient should not be underestimated."

Q. There recently appeared a report of an investigation of the penetration of ultraviolet rays through clothing. What were the main results of this research?

A. The article appeared in the *American Journal of Physiology* and the authors were C. C. Dozier and H. Morgan, of Logan, Utah They found that baby flannel, pongee and crêpe de chine filter out the ultraviolet radiations which are antirachitically potent. "The small amount of interspace in the baby flannel and the large percentage of ash in the crêpe de chine and pongee may have influenced their non-transmissibility. Artificial silk and meadow lane materials transmit the ultraviolet radiations which are effective in healing rickets. However, these materials have the largest interspace and the smallest percentage of ash. These facts seem to indicate that there are factors other than the fiber which may influence the transmissibility of ultraviolet radiation through clothing material."

Q. What are the results of Roentgen-Ray Treatment of Acne?

A. Michael in the *Archives of Dermatology and Syphilology* (May, 1928), reported that

of 191 patients 53 per cent were cured by one course of treatment; 12 per cent were greatly improved and 35 per cent had relapses. Of the total number of cases treated 24 failures were recorded. Twenty of these patients later reported that the disease disappeared after the treatment was discontinued. No permanent ill effect from the roentgen ray was seen in any instance. The average number of roentgen ray treatments in the first course was twelve, with an average total dosage of 2¾ skin units. In the second course, the average number of treatments was five, with an average total dosage of 1 skin unit. It should, however, be remembered that x-ray treatment is best indicated in the case of specially deep, firm and resistant forms. In the mild, superficial forms of acne vulgaris, comedo acne, and papulo-pustular acne, ordinary peeling measures with ointments and ultraviolet light usually bring about a cure.

Q. What is the status of physical therapy in acute pulmonary diseases?

There has been much controversy on this subject and clinicians still differ in their opinions. The fact remains that good results are constantly being recorded. The selection of cases seems to be the important factor so far as consistent results are concerned. Recently there has been considerable clinical trials with infra-red therapy and this energy is now preferred by some to diathermy. Of diathermy, Alexander (*Atlantic Medical Journal,* May, 1928), stated: "While certain of the therapeutic effects attributed to diathermy — such as increased temperature or bactericidal effect —are still in question and will afford ample ground for much disputation for some time to come, the prompt relief of pain, the great improvement in the general comfort, and the consequent uplift of the morale of the patient, give to diathermy an increasingly prominent place in the treatment of lobar pneumonia and pleurisy."

Q. Has the radium treatment of tonsils proved successful? What class of cases are appropriate for this therapy?

Scal and others are staunch advocates of radium treatment of tonsils, but do not advocate such treatment as a routine means of removal of tonsils. Scal contends that it is the method of choice for such selected cases as are inoperable for one reason or another. Williams (*Am. J. Roent. and Rad. Therapy,* April, 1928), is of the opinion that the method is safe and efficient and the recurrences few, whereas after tonsillectomy they are frequent. "Radium treatment is not subject to the complications that may accompany or follow operation. Radium has a wider field of usefulness than that covered by tonsillectomy in that it can be employed for patients who are not good operative risks, and what is also important, for treating diseased lymphoid tissue in the pharynx and other parts of the throat. When radium treatment is available, properly carried out, and its advantages better known, tonsillectomy, as a rule should not be done."

This latter claim needs qualification. Radium therapy of tonsils is still in the experimental stage and until more extensive clinical trials are made one should proceed with caution. Certainly this form of therapy should be carried out only by an expert. In such hands good results should be anticipated.

Q. Is there any difference in the clinical effects from the various types of infra-red generators now on the market?

In general it might be said that the clinical results are good from any of the standard makes of generators now being manufactured. The chief advantage, so far as therapy is concerned, is that of a superficial heating action and this is readily obtained by proper technic. Such technic involves not only application of the generator over the part, but also frequency of application which must be determined by the existing pathology. The type of reflector housing the generator might also be an influencing factor in the intensity and quality of the heat generation.

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

Editor: DISRAELI KOBAK, M.D., CHICAGO

E D I T O R I A L S

THE NINTH ANNUAL SESSION

The ninth annual session opened impressively on Monday, September 8th, in quarters at the New Hotel Jefferson, St. Louis. Three distinct sections served for purposes of instruction in the fundamental and practical aspects of physical therapeutics. These sections on *Medicine, Surgery,* and *Eye, Ear, Nose* and *Throat* conducted classes in the forenoons and formal sessions in the afternoons. No evening sessions were held, but on Wednesday, September 10th, the sections met jointly to listen to a group of papers and addresses of general interest. That the week's gathering represented an intensive post-graduate study was agreed by all. The high standard of the contributions was especially noteworthy, for seldom at any medical meeting was a more scholarly set of papers presented. The general spirit of the convention was such as to reassure the most pessimistic that interest in physical therapeutics is gaining a greater and greater momentum.

Some of the high lights of the respective sections are indeed worth mentioning. The symposium on tuberculosis which occupied the program on Monday afternoon in the section on medicine was unusually instructive. Noted authorities engaged in presentations of different aspects of the subject which was considered from diagnostic and therapeutic standpoints. The lively discussions which ensued certainly served to enrich the knowledge of the listeners. There is no argument that constant research and study in an important problem like tuberculosis are important factors in its solution. That the reports of investigators are always interestingly received was well exemplified by the attitude of this sectional group.

In the surgical section the subject of pelvic diathermy attracted great interest. The progress which has been made in the field of gynecology by several prominent gynecologists merits the keen attention of those engaged in this specialty. During the past few years

numerous gynecologists who formerly were reluctant to consider the possibilities of physical measures as aids in the treatment of gynecologic diseases are now thoroughly converted to the newer science. There is no need to mention names. The numerous articles which have appeared in scientific journals under the authorship of some of the leaders in the field speak for themselves. No wonder then that this subject of pelvic diathermy attracted such intense interest.

The eye, ear, nose and throat section which always has been known for its heated debates did not disappoint at this convention. Many interesting discussions were shared in by fellows and guests. An important omission was the element of overenthusiasm. Probably the one group of papers which proved unusually instructive and valuable was the one dealing with the treatment of diseased tonsils. The paper on the bacteriology of the faucial tonsils was an exceptional contribution. The others covering the various methods of treating the diseased tonsil certainly gave the listener a wide range of experiences. Every laryngologist engaged in the use of some special method eventually becomes enthusiastic over it and probably rightfully so since he becomes highly proficient in its administration. The indiscriminate employment of either surgery or physical therapy should be seriously condemned by the conservative specialist. The time has come when rational procedures must be adopted irrespective of which classification in therapy they fall in. This applies particularly to tonsil therapy, the entire subject of which, is still in an unsettled state. The wide range of subjects covered in the symposium brought out the various aspects mentioned, and when these papers are published they undoubtedly will be read with much eagerness.

The joint section also had some unusual addresses many of which represented reports of original researches. These were of a laboratory and clinical nature. Such subjects as obesity, arthritis, infantile paralysis, cancer and corrective exercise portray the wide field which was covered.

The business sessions of the Congress were two in number. The most important development was the establishemnt of a research council to be headed by the originator of the plan, Dr. J. Severy Hibben of Pasadena, California. Some important and valuable work is in the hands of this council, and doubtless, the future will bring some splendid achievements from it. The council will welcome any suggestions for its constructive development.

The Congress voted to hold its tenth annual meeting in Omaha in 1931. The concensus of opinion was that the tenth anniversary convention should take place in the city in which the Congress was founded as an esteem for efforts of two of its founders, Dr. Albert F. Tyler and Dr. Roy W. Fouts, residents of Omaha.

THE PRESENT STATUS OF THE CANCER PROBLEM

The gravity of the cancer problem has already aroused the widest discussion that was ever given to any single issue in medicine. The medical profession is at present combating this situation with a unified purpose and with a singleness of mind seldom ever observed in its history. The search for some means of its eradication is today the universal concern of not only the physician, but of many of the outstanding research scholars in science. Each phase and every angle of its life cycle is at present under the closest investigation. Every year has seen an enormous contribution to its literature; every particular change in its existence or in variation has been recorded in a most meticulous manner. The laboratories have studied its ultramicroscopic, microscopic and macroscopic formation. From the cytologic point of view the cancer cell is as thoroughly identifiable as though its criminal life history was checked by the most precise method of detection known to science.

In spite of all efforts cancer is still the bewildering mystery which has puzzled investigators for centuries. It is by far the worst and most important disease tormenting mankind. Its cause is, unfortunately, still unknown, its onset is still insidious, its early development is still painless and its spread is definitely on the increase.

Many methods have been advanced to eradicate this disease, and they differ very little in principle than that utilized by the Ancients. Extirpation of the tumor was practiced some two thousand years ago and earlier. Ewing[1] calls attention that "The Ancients knew cancer well. They treated it by excision and by a variety of escharotics, including the Egyptian arsenical ointment. Herodotus mentions

that Democedes (520 B. C.) cured Atossa, the daughter of Darius Hystaspis, of breast cancer, and Hippocrates burnt out a carcinoma of the neck, the earliest record of diathermia.

"Celcius distinguished several gross varieties of cancer, and he excised breast cancer, advising against the removal of the pectoralis major. Treatment by charcoal was employed by Cato, and a variety of crude internal remedies are mentioned by Pliny—

"Diagnosis rested chiefly on the cause of the disease, while treatment by excision, ligation of the vessels, and cautery were comparatively successful. Leonidas of Alexandria (A. D. 180) broke away from Hippocrates' conservatism, dissected out breast cancer extensively, cutting through healthy tissue with knife and cautery, and approached closely to the modern technics of this operation."

The best informed frankly confess that the yield from the thousands of investigations, carried on through many generations, have been sterile in result. The following citations are opinions reflecting the sober attitude of competent authorities on the subject of surgery in relation to cancer.

Deaver and McFarland[2] conclude their discussion on malignancy of the breast with the following disheartening statement: "A generation of workers have labored with great industry, intelligence and patience, and a mass of information has been collected, but when it is carefully sifted, we find ourselves very much where our forefathers were, so far as any clear ideas of the cause and nature of cancer are concerned. But what is most disappointing, we are precisely where they were so far as the treatment of the disease is concerned. All that they knew was that the proper treatment of cancer was to remove it. All that we know is to remove it—"If there be a disheartening subject to think about or to write about or to write about in connection with the much-vaunted progress of modern medicine and surgery, it is our inability to penetrate into the mystery of this disease."

Francis Carter Wood[3] is no less discouraging in regard to the treatment of Cancer by some specific serum or drug. "It has long been the hope and earnest endeavor of the medical profession to discover some simple form of drug or serum which would cure cancer, but, unfortunately this has not yet been accomplished, and the reason is obvious. If cancer cells are merely an overgrowth of normal cells of the body, how can a cancer cell be destroyed by medicine without at the same time destroying the healthy cells? And in this dilemma lies the problem of the medicinal cure of cancer. Unless some constant difference can be found between cancer cells and the corresponding normal cell, such a remedy will never be obtained. Much time and research has been spent by scientific men in order to find some such difference, but so far the search has been fruitless, for the more carefully the cancer cell is studied, the more we find it resembles in almost every particular, rapidly growing cells of the normal type. The analogy with bacterial disease fails completely here, for most of the parasites which are present in the body are either vegetable or low animal forms.

"The probability is that only after long periods of careful and patient study will we find some difference between the normal cell and the cancer cell which will enable us to attack it. That phase of the problem, however, offers no present prospect of solution."

Other competent observers have at times contributed thought-provoking or irrelevant discussions to this major subject. Science is still divided in regard to its etiology. There is still a host of people who champion the trauma and irritation theory, the infectious theory, or old age and physical decline as the causative factor in production of cancer. Many speculations have been advanced by competent men who are considered authorities in their respective fields. These, however, have been scattered over a wide field of unproven experiences. The constipation theory as advocated by Sir Arbuthnot Lane[4] is a case in point. Fascinating as the suggestion might be, it has been considered definitely inconclusive because of the large admixture of spacious argumentation incorporated in its text. There are too many obvious loop-holes in its fabric to warrant its popular acceptance as a scientific contribution to the cause of this puzzling disease. Lane's arguments are unquestionably impressive at the first glance. Most readers will agree with him that "civilization brings into being an additional and serious factor, namely, constipation—which throws an excessive strain on the liver, kidneys, uterus, and other organs which eventually fail to perform their functions efficiently and undergo destructive changes."

Lane's contention is not an isolated argu-

ment in regard to the dangerous effects of bowel stases and hence he does not stand alone in his views. Frequent mention has been made by many authorities (Metchnikoff, Moynihan, Ochsner, etc.), in reference to constipation as a potent factor in the development of cancer, but thus far no incontrovertable proofs have been furnished which bear the stamp of scientific labor.

Trauma and irritation are at present evaluated as important provocative factors. The essential cause is still to be discovered. Bainbridge[5] views are as pertinent as though written today. He sums up his views in the statement: "While the modern experimental investigations of cancer have thrown considerable light upon certain predisposing factors in the production of cancer, the essential cause is yet to be discovered. Perhaps the most practical outcome of such a study is the emphasis to be placed upon the removal of all possible sources of chronic irritation and of benign neoplasms which are subject to irritation."

The best informed frankly confess that the investigations of thousands of patient researchers have yielded only negative results. The removal of irritant foci is stressed by Wood,[6] but he qualifies his remarks in this fashion: "There are families in which all ordinary irritation never produces cancer. In others, the great frequency with which cancer occurs in a number of generations points to a tissue susceptibility which permits the developments of cancer from irritations so slight as not to affect the more resistant type. Nevertheless, it is almost certain that if those born in even the most susceptible families would avoid all sources of irritation, cancer would not occur—." It is lamentable that this writer omitted to include that most invaluable of secrets, namely, how to "avoid all sources of irritation" during the human life cycle.

Of the many counter-measures that have been instituted as a defense against this disease three definite procedures have been adopted by the medical profession. They are, first, education of the lay people about cancer and its dangers, and the perils of procrastination in the presence of indolent growths or chronic disease past the middle period of life; second, the radical removal of neoplasms at the earliest possible moment; third, the intelligent application of radium and x-ray.

In the absence of any specific knowledge in regard to its genesis and procreation, the profession has been forced to adopt certain measures that are in the final analysis only defensive in action. The need for popular education to check the cancer spread and to point out its dangers has been keenly recognized by the profession in order to acquaint the public about some of its early manifestations. It has been felt that the cure of the cancer patient has been severely handicapped by his ignorance of the early signs, and his appearance at the hospital with what might be termed generalized carcinomatosis. The very large mortality in the great majority of these cases and the possible alleviation and even the cure of the early and localized growths have made it obvious that our first line of defense is the spread of popular information about this disease.

One of the foremost advocates of popular educational exploitation is Bloodgood who recognized its value many years ago.[7] In an article written by him in 1923, he has this to say to the public: "If one wishes to be protected from death of cancer one should consult one's medical adviser and find out whether the skin or some other defects are of the dangerous kind. If it is, it should be removed properly, and in this way one is protected from cancer—. Everyone who observes on the lip, tongue or mouth, a fever blister, a canker sore, a red area, an unhealed sore of any kind, an area of irritation, or anything that can be seen and felt different from the normal mucous membrane should see his medical adviser." When the public will recognize the soundness of this advice and the urgency for consultation with medical advisers, the mortality and the morbidity will be materially reduced.

Probably the greatest single stride in the therapy of this disease has been the scientific introduction of radium. There has been a noticeable change in the attitude of some of our outstanding surgeons with reference to the management of these cases. Surgery is now advocated with due conservatism because of the ensuing trauma, shock, morbidity and heavy mortality. The surgeon now divides his cancer cases into those that are operable and non-operable. Of the operable case the results have been far from satisfactory. The non-operable cases have drifted into the hands of the charlatan or have waited with resignation

for the relief offered by death. From these hopeless cases the radiologist was eventually able to demonstrate many successes. Cade,[8] in his recent book has remarked, "that in the last ten years rapid progress of radium therapy has changed the conception of operability, and for the disappearance of the cancerous lesion, it is no longer imperative to rely upon the scalpel—. No one claims that radium is a specific for malignant disease. It has a limited use but wider than of surgery alone. In certain situations it has displaced the knife. In others, it has added to it a possible means of prolonging life. One fact stands out very clearly, no patient, however "inoperable" should remain untreated."

Of the vast amount of energy that has been expended in the search for a specific cause and cure of cancer, the results have been relatively negligible for cancer is still on the increase. At best we have seen only slight rifts in the clouds of this problem. The depressing conclusion that one arrives at after a survey of the many contributions of recognized men is that the problem is still a mystery and that the therapy is still in its infancy.

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THE PHYSICAL THERAPY DEPARTMENT AND THE HOSPITAL

The large number of hospitals which during the past few years have instituted departments of physical therapy is indeed well worth remarking about from time to time. It seems that the modern hospital is a progressive and important business in any community and as such it must be alert to the innovations which constantly present themselves and which possess merit from business and scientific standpoints. It cannot, however, be said of physical therapeutics that it is a fad and that only psychological results are achieved with it. Scientific men and women have entered the field and have taken on the specialty as their life's work. In this connection, C. J. Cummings, Superintendent of the Tacoma General Hospital recently stated: "One of the latest additions to the therapeutic services of the hospital is physical therapy. This branch of medicine includes the treatment of disease by means of physical agencies, namely, electricity, water, massage and exercise. It was long considered a mere fad by a large percentage of the medical profession, but is now recognized almost universally and has been given its proper position alongside of medicine and surgery."

The physical therapy department of a hospital serves in several ways. First of all it is an aid to the sick and injured. The internist, the surgeon, the specialist seek and obtain valuable services, preoperatively, and postoperatively. The successful results in selected cases of pneumonia have inspired the internist to resort to assistance from the physical therapy department. The pediatrician welcomes the use of ultraviolet light for the infants and children under his care, while the surgeon with surgical diathermy meets the difficulties of the cancer problem with a bit greater confidence. It is almost preposterous to think that a modern hospital can call itself modern without the facilities necessary to carry on in this field. Of no lesser importance is hydrotherapy and massage and the technician in a physical therapy department should be competent to perform the duties incidental to these treatments.

Unfortunately, several hospitals have been lax in other details than therapy. They have failed to utilize their departments for teaching purposes, a vital function they are capable of performing. The curriculum of every nurse's training school should now include theoretical and practical work in physical therapy and the medical director of the department should supervise and give such instruction. If the department is large enough, or if it be in a charity institution it can serve for instructional purposes not only for nurses but also for physicians. The physician is eagerly seeking authentic information on physical therapy. Certainly the hospital is a better place for him to secure it than the manufacturer's clinic.

Pertaining to the business side of a hospital

physical therapy department, much can be said for and against it. Granger in reviewing this subject, wrote: "To a civil hospital a department of physical therapeutics may mean increased expense or it may be a source of income. This depends on whether or not a charge is made for treatments. At the Boston City Hospital, the expense has been greatly augmented; but even here by lessening the stay in the hospital of patients, the same number of beds has served many more, hence theoretically lessening the per capita cost. On the other hand, at the Reconstruction and Beekman Street Hospitals, New York, the physical therapeutic department not only is self-supporting but also adds an appreciable sum to the hospital income. Thus there are ways to handle the situation in accordance with the requirements of the institution."

Most gratifying sights are the physical therapy departments of some of the hospitals of the East, Central West, and West. Their operation is thoroughly supervised and the scientific conduct of keeping records and administering treatments could serve as a model for other hospital departments. Those who are fortunate enough to be able to visit some of the newer hospitals of New York, St. Louis, Chicago and Los Angeles will indeed be pleased to observe the actual progress which is being made in hospital departments of physical therapy.

To further add to such progress the Archives announces that with the beginning of its new volume in January, 1931, a section will be devoted exclusively to institutional physical therapy under the departmental heading of "Physical Therapy and the Modern Hospital." Suitable contributions for this department are invited. If you have a hospital department of physical therapy which you would let the world hear about, this new section of the Archives will serve your purpose admirably.

THE RESEARCH COUNCIL OF THE AMERICAN CONGRESS OF PHYSICAL THERAPY

A step forward in the direction of greater progress is the formation of the Research Council of the American Congress of Physical Therapy. This is obviously the first organized effort of a national organization to promote and foster scientific investigation of problems in physical therapeutics. While the economic status of the present day is such as to discourage somewhat the inclination of philanthropists to contribute towards this newer cause, it is the opinion of those vitally interested that substantial help will eventually be forthcoming.

There is an increased need for research in physical therapy. The added impetus of improved teaching facilities, of enlarged hospital departments, and of greater organizations has definitely demonstrated the necessity for more intensive study of the unsolved problems in this newer science. The universities are manifesting a keen interest in the investigations on light, heat, electricity, massage and corrective exercises, to such a degree that postgraduate workers are choosing subjects in these fields for graduate theses. But even with this encouraging spirit, unless such a unified effort as is contemplated by the research council is pressed, the desired progress will be hindered and only spasmodic evidences of accomplishments observed. A unified effort such as is proposed by the Congress seems essential for prompt and successful results.

The American Congress of Physical Therapy is now in its tenth year. It is highly fitting that for its tenth anniversary some substantial contributions be received to make possible the visions of the pioneers of this scientific body. Already the prospects are bright. From certain sources there appear to be better than remote possibilities of acquiring funds to carry on. The council committee which is headed by Dr. J. S. Hibben of Pasadena, has undertaken to put over this proposition and there is little question but that it will. Naturally, cooperation in this as in other projects is essential for success. The assistance of the fellows is solicited. The committee welcomes suggestions and will gladly correspond with anyone who is sufficiently interested to further its purposes.

While no definite plans have been formulated, it is proposed to establish numerous fellowships in leading universities and medical schools. These fellowships will, of course, be under the jurisdiction and supervision of the heads of respective departments, viz., physiology, physics, medicine, surgery, otolaryngology, etc. The graduate student selecting a problem proposed by the council for investigation will be compensated in fellowship dues by funds from the council endowment. The

thesis after serving its purpose with the college authorities will then become the property of the American Congress of Physical Therapy. The details of this crude plan will be worked out by the council and will then be published in the form of an official report. In the meantime the council is eager to secure the necessary funds with which to operate and officially solicits financial support and assistance from individuals, corporations and estates who are in a position to contribute for the elevation of science in general and for the good of physical therapeutics in particular.

RADIUM TREATMENT OF CANCER OF THE UTERUS

The Cancer Research Committee of The Marie Curie Clinic has, after a period of diligent investigation, summarized its work in the form of a report, divided into seven sections.

(1) *The Present Status of Radium Therapy.* The statistics, published since 1927, by clinics using radium are analyzed and compared with the figures from the Wertheim Clinic. In 1927, Dr. Lane-Claypon published the results of 80,000 cases treated at different clinics by surgery and by radiology. This report shows that the final survival rate is practically the same for irradiation as for surgical operation.

The analysis of the reports from the clinics using radium is not altogether satisfactory, owing to the different presentation and data.

The primary mortality varied from 2% to nil. Heymann alone gave his "absolute cures," 20%.

At the Paris Clinic the results have steadily improved since the combination of external irradiation with the local application of radium has been the routine method of treatment, and the field of usefulness of radium in cancer of the cervix has been greatly extended.

This Clinic shows "relative cure," of 30% for 1923.

(2) *Methods and Principles of Technique.* At the present time, in the leading clinics of all countries, the total dosage is very similar, and the differences in the method of treatment concern chiefly the distribution of the radium, its intensity, and the time of application.

The technical methods used in Europe can be grouped under four main heads:

(a) *Stockholm Method.*—The technique consists in placing in the uterine canal an applicator extending the whole of its length, containing 1 to 4 radium tubes in tandem. At the same time cylindrical applicators or flat containers are placed against the growth in the vaginal vault. The object is to cover the whole surface of the growth in the vagina.

The dosage is not rigid and has to be varied for different cases. Three treatments are given, the second a week after the first, and the third three weeks after the second.

The uterine applicator contains 38-43 mgrm. element in one tube, or 25 mgrm. E., each in two tubes, or 10 mgrm. E. each in four tubes. The vaginal applicators contain about 60 mgrm E. The total dose is from 2,000 m.e.h. to 2,600 m.e.h. in the uterus, and 4,500 m.e.h. in the vagina; the total vaginal dose never exceeds that figure. Screening by 3 mm. lead.

(b) *Fondation Curie, Paris.*—Total amount of radium used is about 66 mgr. element; six tubes are used: 4 containing 13.3 mgr. E.; 2 containing 6.66 mgr. Three tubes are inserted in tandem in the uterine cavity, and are distributed along the entire length; the remaining three are placed antero-posteriorly in the vaginal vault, one centrally against the cervix, the other two in each lateral fornix. The vaginal tubes are screened by 6-10 mm. of collodioned cork, the lateral tubes being kept apart by a spring. The screening is equal to 1 mm. of platinum in the uterus, and 1.5 mm. of platinum in the vagina.

The treatment is given continuously for 5 or 6 days, the tubes being taken out daily and replaced in position. The total dosage may reach 9,300 M.E.H. The treatment of choice for the majority of cases is the combination of local treatment with x-rays or radium externally.

(c) *Munich (Doderlein).* — Treatment given in two sessions at 8 weeks' interval Importance of repetition is emphasized.

1. Deep x-ray to the pituitary gland;
2. Next day deep x-ray to the pelvis;
3. Five days later local treatment to the growth.

Intra-uterine and intra-cervical applicators are used, and vaginal applicators may be used as well; apparently the vaginal applicators are not an essential part of the technique. Intra-uterine dose is 55 mgr. element for 24 hours, and does not exceed 1,400 M.E.H.; the vaginal dose is also 55 mgr. and does not exceed 1,400 M.E.H.

(d) *Tube and Needle.*—Good results have been obtained by Ward and Farr, but details are not given except that a cervical applicator, together with 6 needles embedded in the cervix and parametrium, are used. Total dose 2,400-4,200 M.E.H.

This method is looked on with disfavor by the Paris and Stockholm clinics because of the difficulty of placing the needles with precision in the vaginal growth, and when only one treatment is given, the zones of lethal radiation are fixed, and tracts between the needles may be ineffectively radiated. The introduction of needles or tubes into the pelvic tissue through the vagina may set up pelvic sepsis.

(e) *Principles of Technique of the Marie Curie Clinic.*—The method used is a modification of the Stockholm technique; flat vaginal applicators, which give a wider zone of radiation than cylindrical applicators, are used. The combination of external radiation and local application is the method of choice in most cases.

(3) *Screening.* The applicators are illustrated; their screening is given.

(4) *Technique*: *Marie Curie Clinic.* Preliminary preparation includes general examination, blood-count, disinfection with acriflavine, treatment of anæmia, etc. A general anæsthetic is usual for the first application.

For cancer of the cervix, the intra-uterine applicator containing the radium tubes in tandem extends the entire length of the uterine cavity. A flat applicator is placed in each lateral fornix as far out as possible towards the pelvic wall. A third applicator is then placed centrally against the cervix. The position of the applicators is slightly altered each time, and at the third treatment 2 applicators will usually fill the vaginal vault. The intra-uterine tubes contain 50 mgrm. R.E.; screening, 1. mm. platinum; 1.5 mm. of rubber. The vaginal applicators each contain 5 mgrm. R.E.; screening, 1.3 mm. platinum. The applicators are kept in position by a gauze pack soaked in acriflavine. The total dose averages about 7,000 M.E.H. and the maximum dose does not exceed 8,000 M.E.H. The majority of cases have three exposures.

(5) *Contra-indications and Complications.* The principal contra-indications comprise serious pelvic or general infection and advanced cachexia associated with distant metastases. The lighting up of infective processes which may lead to pelvic abscess; general peritonitis is the principal cause of the few primary deaths.

Conclusion. "Though future progress depends on advances in technique, it also depends on earlier diagnosis. The treatment is so much a specialized field that it should only be undertaken at centers designed and equipped for the purpose."—*Irish J. Med Sc.*, Sixth Series: 483 (August), 1930.

The following committees of the American Congress of Physical Therapy were appointed by President Roy W. Fouts to serve during his term in office:

Membership

Balmer, Walke, Frischer, Bierman, Hibben, Holman and Nugent.

Technical and *Scientific Exhibits*

Tyler, Brookhart, Grimes, Goldberg and Titus.

Research Council

Hibben, Titus, Levine, Kobak and Portman.

Publicity

Kobak, Titus, Hibben and Thorek.

Technicians' Bureau (Board of Examiners).

Kobak, Coulter and Ewerhardt.

Standardization of *Equipment*

Coulter, Linn, Kobak, Kolischer an Elsom.

Program

Hollender, Tyler, Polmer, Worster and Krusen.

Publication

Kobak, Tyler, Hollender, Elsom, and Swanberg.

Constitution

Titus, Peterson, Reed.

PHYSICAL THERAPY CLINICS

THE USE OF THE ELECTRO-SURGICAL KNIFE (ELECTRO-SURGERY) IN MAJOR OPERATIONS *

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In the past few years, the use of high frequency currents in surgery—whether for destruction or the excision of normal or abnormal tissue—has merited scientific recognition, and is now an established method of procedure in the treatment of surgical cases.

Two factors have contributed to this result; first, empiricism has been dethroned, and second, confidence in, and professional respect for, the new technique are gradually convincing the surgical world of the advantages herein offered, and that the use of the high frequency current for cutting of tissue represents the latest advance in surgery.

In this paper, I shall not discuss either electro-dissection or electro-coagulation, inasmuch as these terms imply a step or procedure which may precede the use of the cutting current, or used irrespective of any cutting current, and for destruction of tissue only.

In passing, I must emphasize the fact, however, that a thorough knowledge of and experience in electro-coagulation, i. e., where the heat is raised to a degree high enough to coagulate the tissue-proteins, and electro-desiccation, where the degree of heat, while insufficient to cause coagulation, is high enough to kill the tissues by depriving them of water, i. e., by drying them, is a preliminary requisite before using the cutting current or arc operation.

Cumberbatch states that "they (i. e., the currents) form a film-like arc around the active electrode, when the latter is inserted into the tissue and the arc plays the part of a scalpel".

The inactive or indifferent electrode consists of a large metal plate, or disc, applied to some part of the patient's body—upper or lower portion of trunk—and is connected with one of the terminals of the machine.

With this brief preliminary, we may well propound the query—why use the electro-surgical knife in preference to the ordinary scalpel and what advantages are there in such use?

In using the electro-surgical knife in general surgery for a period of more than two years at the Harvard Private Hospital, I am convinced that the average operator does not comprehend its great advantages over the scalpel.

It must be admitted that the electro-surgical knife cannot be taken up and used as one would use an ordinary scalpel. The operator must first familiarize himself thoroughly with the essential features of the adjustment of the machine and the practical application of the electric current generated by it, not only for cutting, but also where electro-coagulation and electro-desiccation is necessary.

In excising normal or abnormal tissue, the small blade does not cut the tissue. That is done by the small arc from the tip of the blade. The tissue is easily separated and presents a surface slightly whitened. The coagulation of the divided surface is of about the depth of a millimetre and depends upon the current and the rate of movements of the knife. Hence, at this early stage of the operation, it is extremely important to gauge the movements of the knife. The area for operation is prepared as for any operation by the scalpel.

The foot-switch is under the supervision of the assistant who is directed in her motions with the words "on" or "off" as the current is wanted or not by the operator. The machine is thus set for operation with low volt-

*Read before the Ninth Annual Meeting of the American Congress of Physical Therapy, St. Louis, Mo., September, 8, 1930.

age, low dehydration, and the power control adjusted to 35-45 and increased, as needed, to give the proper current for the various structures to be cut,—the skin and fatty tissue requiring a greater current than the connective tissue or peritoneum, or the severing of intra-abdominal adhesions.

The active electrode or blade is now brought into contact with the skin or tissue, and just before the blade touches the tissue, a minute arc appears at the spot where the point of the blade makes contact with the tissue. The blade encounters no resistance as it is moved along the line of incision,—the tissues seem to separate of their own accord, presenting a white surface which appears slightly coagulated. This division of the tissue and this coagulation are caused by the film-like arc which surrounds the blade electrode, guided by the surgeon—the cutting not done by the blade as a cutting surface like a scalpel, but by the arc.

The depth to which this coagulation proceeds on either side of the blade depends upon the rate of movement of the blade and the adjustment of the machine. If moved slowly, the coagulation will be that of about one millimetre. This is generally the case when the machine is so adjusted as to furnish maximum current. If the blade is moved rapidly, the coagulation will be a small fraction of a millimetre. If the blade is moved with extreme rapidity, the arc will be extinguished and the tissue cut mechanically as though a dull scalpel was used. If the blade is stopped, there will be a rapid rise of temperature around it and coagulation will take place. Even though the current is passing through the tissues, the movement of the blade will prevent the accumulation of heat and the temperature will not be sufficient to cause any coagulation of the severed surfaces.

I have mentioned these minute essentials to convince you of the necessity of exercising a delicate touch,—so to speak—in operating with the electro-surgical knife, and also call to your attention the great importance of thoroughly mastering the technique before using the electro-surgical knife upon the surface of human body, or within the abdominal or pelvic cavity where, especially, no other instrument can render like service.

When the incision is made by the electro-surgical knife, the minute vessels (blood and lymphatics) are sealed so that there is little or no escape of blood or lymph. Of course, if the larger vessels are severed, then hemorrhage takes place and these vessels must be ligated unless they can be sealed by diathermic method, i. e., grasping the bleeding vessel by hemostatic forceps and then passing a current through the forceps by the blade of the knife. The forceps acts as an active electrode and the vessels are coagulated and sealed by the heat. In general, I prefer to ligate the large vessels.

It is very evident to the operating surgeon that the sealing of the blood and lymph vessels not only gives a clearer and better operating field, whether on the surface as in amputation of the breast, or in the deep area where the gallbladder is involved, or down in the pelvic cavity when removing growths therein, but also the assurance of preventing dissemination of cancer juice when dealing with malignant cases.

In such operations as amputation of the breast, the electro-surgical knife can be used just as freely as the ordinary scalpel for the entire operation. The axillary vessels are protected by the wooden tongue depressor so that no damage is inflicted on these vessels. The glands are readily and easily dissected away from their attachments. The *pectoralis major* and *minor* are severed from their attachments, and the field of operation rendered practically free by any constant oozing from blood vessels. A smaller number of haemostatics is required, and hence, the field is less obstructed; ligatures are required only on the larger vessels.

In appendectomy, the field of operation is rendered practically dry and rendered sterile by the use of the electro-surgical knife. Likewise, in cholecystectomy and in the deep pelvic operations the same favorable conditions exist when using the electro-surgical knife.

Another self-evident advantage in these operative fields consists in the elimination of a large amount of oozing which impairs the vision and prolongs the time of operation, and also eliminates the use of a large number of haemostatic forceps which more or less impede the activity of the surgeon.

In supravaginal or panhysterectomy, the advantages are still more in evidence as the oozing is there reduced to a minimum; the time

consumed in sponging is almost nil; and the space in the operating field is nearly free from the presence of forceps, except for purpose of grasping the tissues. These features alone are very important in those cases which will not admit of too much handling the diseased tissues, or withstand a too long prolongation of the operation. Many a serious case, on which we have operated by the use of the electro-surgical knife would not, in my judgment, have stood the use of the ordinary scalpel because of their critical condition. The extra time required would have jeopardized their chance of recovery. Then, too, the necessity for drainage has been modified, in either not using any drain, or reduction of drainage time, and when so used very little postoperative serous discharge.

Primary union of the severed surfaces has been the rule in general; postoperative stitch abscesses have been wanting; scars, in general, have been soft and pliable with no tendency to a keloid condition. Postoperative pain has been practically *nil* because the nerve filaments have been seared over and nerve irritation averted; hence, the use of morphine has been almost entirely eliminated. The complications of wound infection are reduced to a minimum. While these facts can be substantiated by the experience of the patients, and the subsequent convalescence, I desire to briefly cite one unusual case and one teeming with disappointments:

Mrs. E. N., age 73, appeared at my office January 12, 1928, in company with her daughter, for examination and advice as to treatment. She had had prolapsus uteri for 20 years; cervix eroded; vaginal walls thickened almost like leather; large ventral hernia in median line; urination frequent, and especially so at night, and accompanied with odor, but no blood in urine. Heart irregular and intermittent—pulse 100.

After local examination, I suspected that the bladder would reveal another condition, and hence, after a week's preparation, in washing out the bladder—inasmuch as pus was present in the urine—the patient was cystoscoped on January 19th, and two calculi were observed—one about the size of the little finger and half the length—the second calculus was larger than an English walnut.

After due consideration of the conditions confronting me, I decided to do a suprapubic cystotomy and this was performed January 31, 1928, at Harvard Private Hospital and the notes from the records are as follows:

"Ether anaesthesia—bladder filled with boric acid solution. Incision to the right of median line on account of the large ventral hernia. Unable to fully pull bladder wall into wound, and hence, uterine sound introduced into bladder and bladder wall raised on tip of sound like a pole in tent. Bladder wall, on each side of the sound's tip, grasped by Allis forceps and upward traction made and thin wall of bladder cut through, allowing the boric acid solution to escape.

"Incision then enlarged and the two stones delivered. Wound in bladder completely closed, and also the abdominal wound. Self retaining catheter inserted. Quite a slough of the subcutaneous fat complicated the healing of wound, this being the only case where a necrosis followed the use of the electro-surgical knife. Wound ultimately healed with excellent result."

In this case, the dehydration was light, the voltage was low, power control 35-50. The patient was discharged March 9, 1928.

I am fully convinced that the use of the electro-surgical knife in this case was a most important contributory factor in the success of the operation and the convalescence of the patient. This lady—now 2½ years after the operation, is in comparatively good health. She later was operated on for the hernia, and the prolapsed uterus was supported by a pessary.

In reference to abdominal adhesions, which are liable to complicate and follow any abdominal operation, I am convinced that the use of electro-surgical knife in severing adhesions, is the only successful and practical method in dealing with such cases, and furthermore, it offers the best assurance, if any can be offered, of a non-recurrence of the same.

The following experience, however, does not bear out my convictions or my conclusions, and I cite this case as the only disappointing one thus far encountered.

Miss H. G., age 29, was diagnosed as suffering from adhesions following an appendectomy in 1926. She had consulted several physicians and had been examined at two of the best hospitals and was told that nothing was the matter except extreme neurasthenia.

When I first saw her she revealed unmistakable signs of extensive intra-abdominal adhesions and the only relief as suggested to me, was to sever these adhesions by the use of the electro-surgical knife.

These adhesions have been so operated upon four times, the last operation being performed June 17, 1930; and while the condition is greatly improved and the patient has gained weight and strength, she is not free from the symptoms of abdominal adhesions. I doubt if she will be cured by this or any other operation.

This patient was discharged the last time on Aug. 20th. In conclusion permit me to again point out some of the advantages of electro-thermic surgery. Tissues are readily incised; the incision is absolutely sterile, due to the extreme local heat manufactured in the passage of the electrode through the wound. Bleeding is reduced to a minimum and can be controlled so that the field is dry and free from the encumbrance of many hemostats. The wound usually heals by first intention, and leaves a flexible scar. Shock is reduced to a minimum.

CURRENT NEWS AND COMMENT

The school physician should play a prominent role in physical education programs. All individual corrective exercises should be given only at the suggestion and advice of a physician. The advice of the trained medical man should be followed absolutely in all such cases. The physician also should be recognized as the one most competent to pass judgment on the physical fitness of candidates for the various athletic teams sponsored by the schools.

Another point that should be kept in mind is that of close cooperation between school authorities and the medical society of the community. The counsel, suggestions and fundamental place of the family physicians of every community should not be overlooked in the school health program. Physicians should be asked frequently for their comments on the work being done in the matter of health education and physical training.

That school officials are being urged to develop their health and physical education programs on the fundamentals briefly analyzed above is evidenced by the discussions made at the national conference. It was admitted freely, however, that much remains to be accomplished despite the advancement that has been made of recent years.

Health and physical education among the school children of the country can accomplish much providing the programs instituted are based on sound and conservative methods of procedure and are given proper leadership and guidance. The aim of the Department of School Health and Physical Education of the N. T. A., as stated by its leaders, is to educate school administrators as to the proper ways to proceed and how best to coordinate the various branches of the school health program. The scientific knowledge and practical experience of the medical profession should be most beneficial to school officials in setting up new programs or revising ones at present in effect, and above all school authorities should recognize and not interfere with the fundamental relationship of physicians in private practice and their student patients.—(*Ohio State M. J.*, August 1930.)

A rational discussion of the subject of hypertension is embodied in a scientific presentation "Institutional Physiotherapy as an Adjunct in the Treatment of Hypertension", which appeared in the July number of the *Ohio State Medical Journal.* The important phases of high blood pressure are covered in detail as are the methods of treatment. There are also cited case reports, but the interesting conclusion of the author, Dr. R. M. Watkins of Cleveland, should be quoted for emphasis: "As a final observation," states Watkins, "allow me to say that I am convinced from study of the cases reported, and from perusal of the literature regarding this subject, that we who

are interested in internal medicine are ignoring largely the benefit that may accrue to our patients with arterial hypertension by the employment of institutional physiotherapy in their behalf. Our series of cases are short, but the results are positive. We must conclude that physical measures are valuable adjuncts to our methods of treatment of high blood pressure."

Tumors of the larynx is a subject interestingly reviewed by Patton, in the August issue of the *Journal* of the *Missouri Medical Association.* Under the section dealing with the treatment of tuberculosis, Patton writes: "Tuberculosis is treated the same as tuberculosis involvement in other parts of the body with the addition of galvanic needle, chemicals, curetting and galvanocautery. Galvanocautery is a valuable method of cure. Its beneficial action, it is claimed, does not depend so much on the amount of diseased tissue destroyed as on the local antiseptic action and the stimulation of reaction and of limiting fibrosis. It is suitable for deposits as well as for ulcerating surfaces and it can be employed for the destruction of granulating and fungating surfaces. Cauterizations are employed once a month until complete healing takes place.

In an article on Ringworm of the Hands and Feet, appearing in the August issue of *The Medical Sentinel.* Osborne states, in part, "The drying and heating of the affected parts under the heat lamp has a rational basis and has been carefully worked out by Weidman in the laboratory. A temperature of 48° C. killed most species within 10 min. exposure. This temperature may be withstood with some discomfort by the average foot. We have employed this drying and heating method in conjunction with local applications of the above mentioned forms of treatment with good success and feel it one of the most important parts of the treatment, especially good in the wet, macerated type.

"The roentgen ray has been lauded by a number of observers. In some of the acute eczematoid cases it gives improvement but again it is only one of the many measures which may be tried. There is little rational therapeutic basis for its use in any other form than the acute eczematoid type."

Zubak of Wheeling, West Virginia, writes on the "Removal of Tonsils by High Frequency Currents", in the August issue of the *West Virginia Medical Journal.* After detailing the indications and justification for the method, the author emphasizes the fact that the public demand for a safe, non-incapacitating tonsillectomy cannot be denied. He states, further, that favorable opinions are based on several hundreds of cases and ridicules the versions of those who have condemned the method because of limited experiences with it. The article is an enthusiastic one in contradistinction to the more conservative attitudes recently advanced by some otolaryngologists. There is little question concerning the value of the removal of tonsils by surgical diathermy in selected cases, but the promiscuous and indiscriminate application of the procedure by the untrained and inexperienced is something again which calls for thorough evaluation.

The State Institute for the Study of Malignant Diseases, New York, is soon to be the beneficiary of $291,000 worth of radium and accessory equipment, as the result of an appropriation of $300,000 for the purpose at the last session of the New York Legislature. The State Institute for the Study of Malignant Diseases is under the supervision and control of the State Department of Health. It was created for the purpose of conducting investigations into the cause, nature, mortality rate, treatment, prevention and cure of cancer and allied diseases. It is stated that there are records of 800 cured cases of malignant diseases in the Institute files.

American Hospital Association Meeting

The week beginning October the twentieth will see in New Orleans the starting of the annual convocation of the American Hospital Association. This meeting will last for five days, and during this period many problems relative to hospital management will be brought up, which should be of interest not only to those whose primary duties are the care and running of hospitals and institutions, but also to those who hold positions on the medical and surgical staffs. The topics to be presented will deal not only with the cost-per-day-per-patient problem, the type of refrigeration best

suited for a hospital, and comparable questions, but there will also be round table sessions on the relation of the staff to the hospital, the teaching of internes, the obtaining of autopsies, and similar subjects of considerable interest to the medical profession as a whole.

The general plan of the meeting is to hold open sessions at night. In the morning there will be round discussions and in the afternoon section meetings. The round table discussions and the general meetings will probably be of particular interest to physicians. In the section meetings every phase of hospital life, administration, construction, and finance, will all be elaborated.

This meeting will be not only national in its scope, but also international, as delegates from many of the Central and South American republics will be present, as well as delegates from Canada. The broad range and the diversity of appeal of this annual meeting of the hospital association is indicated by the fact that there are usually registered for the session between 3,500 and 4,000 individuals.

Physical Education Procedure

Much progress has been made during the past few years in the school health education movement, leaders in that field reported at the recent National Education Association convention held in Columbus.

Interesting observations on the work that has been accomplished and optimistic predictions concerning the future were made by those who addressed the Department on School Health and Physical Education.

Many of the speakers were of the opinion that there is a growing tendency for closer cooperation and understanding between the health educator and the physical training instructor.

This is as it should be, for little may be accomplished in school health education should these two branches of the work operate at cross purposes.

The part that the school physician should take in the work also was pointed out by several of the lecturers, indicating a greater realization on the part of school officials of the importance of the trained medical man in the field of physical education.

The American Mouth Health Association is a body of physicians recently organized to promote a better understanding of healthful living, particularly with reference to mouth hygiene, among the lay public. Dr. Thomas B. Hartzell, professor of mouth infections at the University of Minnesota Medical School, is president of the Board of Trustees. The headquarters of the Association are in the Essex Building, Minneapolis.

Sir Oliver Lodge, F.R.S., became a Pioneer of Light more than a generation ago, when he and the late Professor Marshall Ward, of Cambridge, made experiments which demonstrated and defined the antiseptic power of sunlight.

Sir Oliver worked at the antiseptic nature of ultraviolet light along with the late Marshall Ward, Professor of Botany at Cooper's Hill, who sent him preparations of anthrax in jelly which Sir Oliver submitted to an arc-light spectrum through a quartz lens and prisms. The cultures were subsequently developed by Marshall Ward; and it was found that where the lines in the ultraviolet spectrum were strongest, the germs had been entirely killed. Professor Ward's paper is in "The Philosophical Transactions of the Royal Society" B. for 1895.

Their work, done in this country, (England), is definitely linked with that of Niels Finsen in Copenhagen, and the introduction of light treatment into the London Hospital by the influence of our late Patron, Queen Alexandra, in May, 1900. (*Sunlight, Summer 1930.*)

An extremely interesting issue is the Summer number of *Sunlight*, the journal of the Sunlight League of England. Noted contributors to this important publication include Sir Oliver Lodge, C. H. Wilmot, O. J. Sieplein, Arthur Black, Albert Eidinow, Sir Maurice Abbot-Anderson, C. W. Saleeby and A. C. Jordan. The subjects covered are "Ultra Cautious Ways versus Ultraviolet Rays"; "Sun-Ray Research at Miami, Florida"; "The Sun-Cure in England"; "The Use of Rays of Light in Health and Disease"; "The Open-Air Village Settlement Plan"; "The English Countryside"; "Chailey and Childhood"; "Encouraging the Sun-Bather"; "Sunlight in Camp Life"; "A Sun-Bathers' Swimming Pool".

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BOOK REVIEWS

PHYSICAL DIAGNOSIS. By *Richard C. Cabot*, M.D., Professor of Clinical Medicine in Harvard University; formerly Chief of the West Medical Service at the Massachusetts General Hospital. Tenth Edition. Cloth. Price $5.00. Pp. 529. Revised and enlarged with 6 plates and 279 figures in the text. New York, William Wood & Company, 1930.

A quarter of a century has elapsed since this work was first published. With each new edition it has grown in size and in value. It has now reached that enviable stage wherein it is now regarded with that degree of affectionate veneration shown only to those books tacitly accepted as the classics in the field. Its position of high regard has not, however, been achieved by virtue of its seniority, but rather by its progressive exposition and evaluation of the important and voluminous data that enter into the study of physical diagnosis. As in previous editions, so in the present one, it maintains its leadership by virtue of the quality and the selection of the material included in its pages. Although the author does not attempt to qualify the work as encyclopedic, the book so thoroughly covers the subject that it may be designated as fairly exhaustive in its scope.

Important new material is supposed to have been introduced in this edition. In his preface, the author indicates that discussions on coronary disease, electrocardiography, cancer of the lung, "cardiac" asthma, toxic hepatitis, and encephalitis lethargica have been included in the present text. Of the foregoing enumerated conditions, electrocardiography and coronary diseases have come in for short discussions. Little has been said in regard to the other above mentioned conditions and, because of this, it has rather belittled the value of the present edition. For example, no reference is made in the index to "cardiac" asthma. On diligent search one finally discovers on page 76 two sentences that indicate any relation to the topic, namely: "Persons with chronic heart disease may have sudden *paroxysms of dyspnoea*, especially at night. These are sometimes called 'cardiac asthma'. They are bad prognostic signs." The abrupt ending to this topic is as disappointing as is the ten-line discussion on "cancer of the lungs", the omission of any discussion whatsoever on "toxic hepatitis" and the complete let-down on that baffling condition, "encephalitis lethargica". One is forced to the conclusion that the present work is probably much more in the nature of a reprint rather than a new edition. Fortunately, the volume contains a wealth of practical and essential information which the reader can make use of in his daily practice. It may, in spite of the criticisms raised, still be considered one of the leading works on physical diagnosis in the English language.

RHEUMAPROBLEME. Gesammelte Vorträge, gehalten auf dem I. Arztekursus des Rheuma-Forschungs-Instituts am Landesbad der Rheinprovinz in Aachen. (THE PROBLEM OF RHEUMATISM. Collected Addresses on the Investigation of Rheumatism held at the Institute of Landesbad in the Rhine-Province at Aachen.) By *Prof. Dr. Curschmann,* Direktor der Med. Universitätsklinik, Rostock / *Prof. Dr. Eckstein,* Oberarzt der akadem. Kinderklinik, Düsseldorf / *Dr. Fischer,* Oberarzt des Rheuma-Forschungs-Instituts, Aachen / *Prof. Dr. Gräff,* Path. Universitäts-Institut, Heidelberg / *Prof. Dr. Gudzent,* Berlin / *Prof. Dr. Hübschmann,* Direktor, des Pathologischen Instituts, Düsseldorf / *Dr. Krebs,* Chefarzt des Landesbades, Leiter des Rheuma-Forschungs-Instituts, Aachen / *Geh.-Rat Prof. Dr. Payr,* Direktor d. Chirg. Universitätsklinik, Leipzig / *Prof. Dr. Schede,* Direktor der Orthop. Universitätsklinik, Leipzig / *Prof. Dr. Schootmüller,* Direktor der Universitäts-Poliklinik, Hamburg / *Prof. Dr. Thannhauser,* Direktor der Med. Klinik, Düsseldorf. Paper. Pp. 181, with 55 illustrations and 4 colored plates. Leipzig: Georg Thieme, 1929.

The subject matter of this volume consists of a series of lectures that were delivered by a group of outstanding physicians and surgeons on the problem of Rheumatism, held at the Institute for Rheumatic Investigations, at Aachen. The discussion is divided into ten chapters, each one taking into consideration a special topic of this broad and difficult subject. For example, the first chapter deals with the Essentials of Muscular Rheumatism (Myalgia) which is written by Prof. Hans Curschmann of Rostock. The literature and the newer theories are herein reviewed and a comprehensive evaluation of the causative factors, the pathogenesis, diagnosis and the management of this affection is included.

A separate chapter is devoted to a scholarly consideration of Rheumatic Diseases in Children (below 15 years) by Prof. Albert Eckstein. The topic of the blood findings and its relationship to the foregoing problem is discussed by the physician-in-chief of the institute, Dr. Arthur Fischer. He states in the very beginning of his discourse that "in no other study in internal medicine is there a greater need for an understanding of the chemical, bacterial, and serological make-up of the pathogenic living material as in the disease of the motor-apparatus. In the study of the so-called rheumatic affections there is to be found closely associated inflammatory, degenerative, static and infective processes; we see affections with anomalies of metabolism, others intimately related with disturbances of internal secretion, that it is difficult to conclude as to whether they are a part of the picture or a separate entity."

A similar attitude is taken by Prof. Gräff, and Hübschmann, who discuss the anatomical histo-

pathology in individual chapters. A wealth of concise information is included therein. It is certain that these chapters will have a broad appeal for the scientific investigator, for they summarize the major interpretations of the laboratory in a condensed form. There is also included in this section many illustrations that typify the changes that may take place in the various organs of the body. One turns from these pages with a conviction that the rheumatic patient is indeed one of the outstanding problems of medicine.

The volume is well rounded out by chapters that concern themselves with the surgical, orthopedic, medical and physical therapeutic side of the problem. Although each author has limited his discussion to the particular subject assigned to him, it is apparent that Rheumatism is not a problem of any particular specialty but of medicine in general. It is also apparent that no specific medication has as yet been uncovered for its eradication; that the most progressive treatment consists of a combination of the known measures as at present utilized by the scientific physician; and that physical therapy must be included in its management and control. The chapter by Krebs, devoted to the exposition of physical measures, is a splendid estimation of its possibilities and also of its limitations. The author has evaluated its possibilities with due conservatism. Attention is directed by him to the value of heat (superficial and deep) and the production of active hyperemia; to the uses of light therapy, mechanotherapy and to many varieties of massage. Hydrotherapy and medical gymnastics are also included as part of the régime. The author's interpretation of the treatment necessary for the rheumatic patient is not limited to physical measures. His plea is for a more liberal combination of all known remedies. He, therefore, advocates and prescribes all proven medicaments in association with the physical agents enumerated above.

One closes this volume with a depressed feeling that in spite of the vast amount of work that has already been done in the attempt to master this prevalent disease, the profession is still groping in the dark. This volume is a liberal education for the physician interested in the newer interpretations and the scientific treatment of Rheumatism. The book is a timely contribution because it contains many valuable suggestions and arouses new interest in this serious problem. The authors and publishers are to be highly commended for the painstaking literary effort and physical makeup of this volume. It is highly recommended.

PRACTICAL INDEX TO ELECTRO AND PHOTO THERAPY INCLUDING AN INDEX OF DISEASES WITH DESCRIPTIVE TECHNIQUES. By *Joseph E. G. Waddington,* M.D., C.M. (Bennett): Fellow American Medical Association, American Congress of Physical Therapy; President, Western Association of Physical Therapy, etc. Third Edition. Leather. Price $7.50. Pp. 424. Rewritten and enlarged, with 164 illustrations. Detroit: A. M. Margraf & Company, 1929.

The author of this volume has attempted the no small task of collecting and correlating some of the salient theories and data regarding the modern uses of electro- and phototherapy for the benefit of the general practitioner. One is attracted to the individualistic literary style of the writer which may be classified as epigrammatic and "fine writing". He is possessed of that unusual faculty which enables him at times to convert a series of arguments into an epigrammatic conclusion. The theme of the book opens with a vigorous plea for tolerance for any new developments in the field of therapeutics. One hardly feels that there is now any particular need for special pleading for the practice of modern physical therapy. Its foundation is today recognized as sufficiently strong, broad and deep to warrant the assumption of its practical value in modern medicine. One usually finds an inferiority complex as the motivating cause to special *pleadings.*

The author has included many enlightening expositions throughout the book. The discussion on the low frequency currents is particularly well managed. The novitiate will leave this section with tangible comprehension of the practical value of the galvanic, faradic, and the sinusoidal current. He also will develop a growing appreciation of the many uses for diathermy, and phototherapy. The more critical reader will, however, view the volume as made up of many patterns of well selected and also disorganized information. The sections on physics and biophysics incorporates a heterogeneous amount of information that has neither been well organized nor reduced to its scientific essentials. The cross index is uncomfortably weak. For example, one cannot find any reference to biophysics, nor to quoted literature or special authorities. Space will not permit of more specific illustrations. There are three avenues for the presentation of physical therapy information: the highly technical, the middle road and the elementary one. The author, by adopting the latter course no doubt was governed by his desire to reach those uninformed but industrious practitioners who seek essential and primary guidance in electro and photo therapy.

DISEASES AND DEFORMITIES OF THE SPINE AND THORAX. By *Arthur Steindler,* M.D., F.A.C.S., Professor and Head of the Department of Orthopedic Surgery of Iowa State University Medical School, Iowa City, Iowa. Cloth. Pp. 573, with 76 illustrations in plates. Price, $12.50. St. Louis: The C. V. Mosby Company, 1929.

This volume represents an exhaustive exposition of that important branch of Orthopedic Surgery, namely, the management of the various affections of the spine and thorax. The author, because of his very large clinical and teaching experience, is highly competent to discuss the various theoretical and practical phases associated with the subject. He has throughout the entire text purposely utilized the impersonal, didactic style, which permits him the larger opportunity to critically discuss and evaluate the various special contributions to the literature of the subject and to point out the strength and validity of current methods of procedure.

The book is divided into ten large chapters with an additional appendix on the "Synopsis of the

Anatomy of the Spine". Every chapter is an exhaustive interpretation of the topic under consideration. A generous bibliography is appended after each chapter and is an index of the painstaking, scholarly effort that has been expended in the scientific architecture of the book. These source references are frequently of inestimable value for those who have a special interest in the subject. The surgical and orthopedic management of the many affections under consideration is discussed in the broadest manner. The subject of therapy is considered in great detail. Certain apparent weaknesses may perhaps be found in this section, especially in connection with the author's orientation in regard to the proper selection of physical measures and with the management of certain forms of arthritis, low back pains, and sciatica. In justification of the author's meager recommendation of physical measures, he frankly defends his general attitude by stating in his preface, "When the object of treatment is fully explained, and the salient points of the technic are given, obvious and self-evident details of technic can often be spared the reader who is expected to be conversant with general surgical routine. An illustration often will help much better over difficulties of technical details than a circumstantial description". In his discussion of the non-surgical management of sciatica, one reads with a certain amount of impatience that "for two weeks to twenty days following the open stretching operation there is noted an exacerbation of pain, especially of evenings". Nowhere in this section is mention made of the pain relieving and antispasmodic effect of diathermy when properly applied. Nor is heat in any form here advocated by the author. The recommended "faradization," is noteworthy for its uselessness here and is at best a mere therapeutic "flicker" compared to the positive effects of deep heat and local ultraviolet stimulation. The beneficial effects of diathermy and ultraviolet radiation are respectfully recommended to the author for consideration as a valuable adjuvant not only in the above mentioned affection but also in Osteomyelitis and in Arthritis. Heliotherapy has received the most generous mention of all physical therapy agencies in connection with treatment of tubercular lesions of the spine. The discussion of quartz light is amateurish and abbreviated to the size of two paragraphs. No doubt it must have been an inadvertent omission on the part of the author to have left out of his text a discussion of the relative value of the carbon arc in the treatment of surgical tuberculosis. Contemporary literature is so rich in the mention of its value in this connection, especially the formidable contributions from the Finsen Institute that it is felt that no exposition is well rounded or scholarly unless this form of therapy is generously evaluated. In spite of the criticism just advanced, this volume is one of the noteworthy contributions to the subject of orthopedic surgery and is highly recommended to the reader.

SUNLIGHT CLASSES

The experience gained in open-air schools is having a notable influence on the planning of new schools of other types, as is evidenced by the new buildings recently erected under the London County Council. When many of the existing schools were built, few people understood the relation between health and movement, health and sunshine, health and fresh air. Even now practice, in the matter of health, lags behind expert knowledge, but educational authorities are realising the wisdom of designing schools on open-air principles. The London County Council has already erected elementary schools on these principles and others have been planned. There is little doubt that the success of the open-air experiment has had an appreciable effect.

Dr. G. H. Gater, the L. C. C. Education Officer, states that sunlight classes have resulted in improvement in the physical and mental capabilities of the children. Not only are they more alert, but they gain in self-confidence, self-reliance, and general *esprit de corps.* This being the case, one is tempted to ask why all these benefits are kept, almost without exception, for the debilitated and ailing child instead of being shared by all little Londoners. *(Sunlight, September 1930.)*

INTERNATIONAL ABSTRACTS

Physikalische Therapie Der Hautkrankheiten. (Physical therapeutics of diseases of the skin). Herbert Fuhs.

Wiener klin. Wochenschr. 1929, Ann. 42, Nr. 12, (March), p. 361-366.

Diathermy is applied in dermatology chiefly to produce local heating. The duration of an exposure is at least 20-30 minutes. If necessary, the treatment is repeated daily or from 2 to 3 times a week. It merely produces local rise of temperature with a view of promoting metabolism and reactiveness of the tissues and thereby stimulate good healing. The optimal strength to be chosen is that which provokes just an agreeable sensation of heat in the treated parts of the body. Complaint of cutaneous sensibility such as faradic feeling is a warning to be extremely cautious and to investigate the cause. The promotion of circulation and the ensuing stimulation of nutrition and acceleration of absorption, all of them due to diathermy, are turned to account for certain cosmetic purposes (improvement of wrinkles, better vascularization of pale skin, decongestion of cyanotic parts, removal of edematous swellings of the face skin, e.g. of pockets under the eyes). The softening and flattening effect of diathermy manifests itself with regard to keloids and hypertrophic scars adherent to the underlying layer. The author succeeded in favorably influencing sluggish varicose ulcers of the leg and similar therapeutically refractory x-ray ulcers by improving circulation and promoting local metabolism. The spasmolytic effect of diathermy has a grateful therapeutical field in angioneuroses, acrocyanosis, Reil's dead fingers and the initial stages of Raynaud's disease. The anodine effect of diathermy manifests itself by the successful heating of the ganglion region in high grade zosteric neuralgia as well as in x-ray and radium keratoses and very painful roentgen ulcers. Fuhs succeeded, furthermore, in obtaining marked alleviation of itching by diathermy, (eventually in the form of fulguration), in pruritus of the vulvar and anal regions.

Electrocoagulation is resorted to in a series of cosmetic diseases of the skin which have thus far been removed by the application of electrolysis and galvanocautery, as in removal of woman's beard (hypertrichoses), pigmented marks and naevi of acne rosacea. Besides teleangiectasiae, small papillomata, fibromata mollusca, mollusca contagiosa, milia, verrucae planae and vulgares are obliterated. Also xanthelasmata of the eye lids occasionally lend themselves to treatment by electrocoagulation.

Fuhs also applies borderline rays in his dermatological practice. According to the type of affection, from 2 to 6 dose units, as recommended by Bucky, were administered per port of entry and exposure. A maximum voltage of 9 KV proved optimal in skin therapy. The erythema invoked by these rays clears up within a few weeks or, if of stronger degree, the skin becomes pigmented for a long time and results sometimes in a cosmetically disfiguring effect. Never, however, could any remote injuries as teleangiectasiae or ulcers be ascertained in those cases that have been under observation for more than one year. The author urges explicitly, that in consideration of remote injuries which are apt to occur even after an interval of many years owing to different procedures of x-raying, the space of one year is still too short a period to observe the harmlessness of borderline rays with absolute certainty. In sycosis simplex and blepharitis — at least in a series of cases — considerable improvement could be obtained by borderline rays. Most striking, however, were the successes obtained in erythema induratum Bazin, especially in its ulcerated type. Among the cocci diseases it appears that hydrosadenitis follicularis responds best to borderline rays; paronychias, especially of coccogenous and mycotic origin, also showed marked improvement. Among diseases of the blood and allied processes, Fuhs could ascertain a definite recession in the manifestations of lymphogranulomatosis and premycotic, psoriasiform plaques in a case of mycosis fungoides, slower recession in the tumorous stage of the latter. Prolonged observation no doubt will further prove the stability of physical therapy in selected diseases of the skin.

A Propos De La Radiothérapie De L'Asthme. (On the radiotherapy of bronchial asthma). J. A. Huet et Sobel:

Bull. et mém. de la Soc. de Radiol. 1929, Ann. 17, Nr. 160, (June), p. 169-171.

The author reports six cases of bronchial asthma associated partly with tracheobronchial adenopathy, partly with fibrosclerotic changes.

Two fields were irradiated, each anteriorly and posteriorly. The posterior ones, one of which lay on the nape of the neck at the level of the last cervical and first dorsal vertebrae, measured 8 by 10 cm., the other was located in the interscapular space. Spark gap 25 cm., 2½ MA, 30 cm. focal distance, filter 5 mm. Al, 500 R per field.

Both posterior fields were cross-fired parasternally at one exposure, the two anterior ones three days later.

It was never necessary to give more than 10 irradiations, the improvement already starting between the fourth and sixth exposures, cure occurring mostly after the eighth exposure. Generally speaking, the doses given were feeble, never exceeding 2000 R per field.

Ueber Diathermieoperationen. (On diathermy operations). A. Mayer.

Ztbl. f. Gynäk., 1929, Jg. 53, No. 25, (June), p. 1555-1558.

By diathermy a bloodless division of tissue is sought and frequently realized. Doederlein some time ago carried out some studies on the effect of total extirpations and ovariotomies by "spark cut". It appeared from this that the method could not replace the ligation of the large vessels. Healing of the wounds was interfered with by coagulation of the tissue. Later on diathermy apparatus was constructed with a very high amount of sparks (Thermoflux C) and very high amperage (Penetrotherm) and showed on trial that the Thermoflux of the firm Siemens, Reiniger and Veifa to be the most apt for cutting. The division by the electric lancet must be done quickly and cleverly lest it produce local coagulation of tissue by excessive rise in temperature; necrosis occurs, however, directly the motion of the electrode comes to a stop or slows up for other reason. Many consider this method as appropriate for superficial maneuvers. The apparatus served the author best in ablation of vulva carcinomas, and giant condylomas of pregnancy in which roentgen ray irradiation was contraindicated. In larger vessels, hemostasis by coagulation does not take place although, hemorrhages from smaller vessels was readily controlled. The question as to whether and to what extent it is also appropriate for laparatomies must in the meantime be left undecided.

Ulcera Penetrante Della Piccola Curvatura E Cura Roentgen. (Penetrating ulcer of the lesser curvature and roentgenotherapy). Ferdinando Talia.

Radiol. Med. 1929, Vol. 16, Fasc. 1, Jan., p 21-35.

The author arrives at the following conclusions, based on his experiences with roentgenotherapy in four cases of penetrating ulcer of the lesser curvature.

X-ray scarcely acts upon the ulcer, and consequently cicatrisation or definite healing is out of the question. The excellent subjective and objective results are in complete contrast with the radiographs made after the end of the treatment. The improvement is not due to the direct effect of the beams, but to the improvement of the secretory conditions of the stomach. As to the remote results, relapses occur in isolated cases; in others, lasting clinical benefit. However, no radiographical healing can be demonstrated to take place. X-ray leads, therefore, to the relief or disappearance of the pain symptoms that accompany difficulties of secretion and digestion, and produces a material improvement of the local and general condition.

Technique: In two cases 25 per cent of skin unit dose, intervals of about eight days, adequate portals, control by Roentgen pictures; in the remaining two cases irradiation of areas of routine large size with 25 per cent of SUD a week.

Die Bekaempfung Des Roentgenkaters Nach Tiefentherapie. (The fight against x-ray sickness following deep therapy). Georg Heinrich Schneider.

Strahlentherapie 1929, Vol. 32, Nr. 1, (March), p. 205-209.

The syndrome of x-ray sickness calls attention to the importance of the parasympathetic component in the equilibrium of the vegetative system. This vagotony is associated with a slight, but distinctly appreciable increase of the sedimentation velocity of the red corpuscles. It depends particularly on the size of the portal. Large superficial doses have the same effect as a large number of small depth-doses. The decrease of the cholesterin contents which Burgheim has proved to be the expression of trouble of the vegetative equilibrium, is a similar concomitant phenomenon. The fight against this component of x-ray sickness proves very successful on the administration of Colsil. Colsil is a cholesterinic preparation containing in addition some lecithin, and is neither a narcotic nor a hypnotic. Schneider administers two tablets of Colsil, when the irradiation of the first portal is completed, one more tablet of 0,1 being again given after the irradiation of each further portal. In case of prolonged irradiation treatment approaching half the skin erythema dose, say 300 R and more, the author prescribes two tablets with a drink of water at the onset of the irradiation of the first field.

Note: Colsil is put up by the Chemical Works Grünau, Landshoff and Meyer A. G., Berlin—Grünau.

Die Lichttherapie Von Augenleiden. (Phototherapy in diseases of the eyes). Adolf Gutmann.

Strahlentherapie 1929, Vol. 31, Jan., p. 322-324.

The author uses a simple irradiation lamp of focal blue light. Very good results were attained with it in chronic blepharitis, chronic conjunctivitis, phlyctaenular conjunctivitis and superficial affections of the cornea, such as herpes, superficial keratitis and marginal ulcers of the cornea. The rays are administered from 5 to 7 minutes per sitting. The author, in search of a sufficiently strong light source, found a lamp with a light intensity of 100 watts to be the optimum; for the source of light he chose the tungsten filament; the irritative rays which lie in yellow and green, also in red, being eliminated by uviol glass plates. The rays were focused on the corresponding area of the eye by means of a lens of 20 D at a distance of 30 cm. from the illuminating body. It is of great importance previously to sensitize the diseased portion by using one drop of a 2 per cent solution of fluorescein. In case of affections of the eyelids the border of the eyelid should be painted with this fluorescein solution.

Weitere Erfahrungen Mit Der Roentgentherapie Bei Psychiatrischen Und Neurologischen Erkrankungen. I. Der Mongoloidismus. (New experiences with roentgentherapy in psychiatric and neurologic affections. I. Mongolism). M. v. Wieser.

Strahlentherapie 32; 218-290, (April) 1929.

Wieser cites 46 cases of mongolism in which he favorably succeeded in influencing the majority of the characteristic symptoms by roentgenotherapy. In general, all the symptoms of mongolism simultaneously show signs of improvement after the beginning of the treatment. It was ascertained that the influence on growth and erethism sets in somewhat earlier compared to that of the other symptoms, and that alterations of the soft parts can sooner be appreciated than alterations of ossification. One of the last symptoms to show any alteration is, as a rule, that of dysphasia. The reason for that fact is possibly to be found in the manner of irradiation. The irradiations were given in such a manner as to reach the middle cerebral fossa, and hence the center for speech was therefore reached only by very few or no beams at all. The treatment consisted of irradiations of the skull by 5 portals of 6 by 8 cm., 30 cm. skin target distance, 180-200 KV max., filter of 0,5 mm. Zn and 1 mm. Al; each field received 5-10 p.c. of the skin erythema dose, 1-2 fields per week at intervals of from 3 to 4 days. The 5 fields were mostly irradiated twice successively, then followed intervals of 4-6-8-10 weeks. For children up to three years of age it frequently was sufficient to irradiate the whole body with rays of the same quality, the focal skin distance being 2 metres and 2 p.c. of the skin erythema dose which was applied at four weeks' intervals. Wieser maintains that this mode of management is as yet far from being definitely established, as the number of variations of the mongolism is too great to allow of establishing definite prescriptions of dosage for its divers forms.

Contributo Alla Roentgenterapia Dei Processi Flogistici. (Contribution to the roentgentherapy of inflammatory processes). Alberti Pietro.

La Radiologia Med. 1928, Vol. 15, p. 1011-1022.

The author X-rayed 60 cases of inflammatory diseases; namely, acute and subacute lymphadenitis, hidrosadenitis of the axilla, pyodermitis, furuncles, carbuncle, periodontitis and periostitis of the mandible, whitlows, abscesses, phlegmons due to foreign bodies, wood phlegmon, dacryocystitis, otitis externa, acute septic arthritis associated with lymphangitis, gonorrheal arthritis, acute and subacute gynecological diseases (peri and parametritis, adnexitis associated with endometritis, inflammatory growths of the adnexa, sactosalpingitis), postoperative pneumonia and lobar pneumonia. The number of excellent and good results amounted to 53, or 88 per cent.

The technique applied by the author varied according to the special conditions of the case. Rays of a lower or higher degree of penetrative power were administered by filters of different thickness, viz., in superficial inflammations rays at 20 cm. spark, 1,0 mm. Al; in subcutaneous inflammations at 30 cm. spark gap, 1,0 mm. Al, and in deep-seated ones at 36 cm. gap with 0,5 mm. Zn., plus 1 mm. Al; the focal distance which commonly amounted to 25 cm. was, in gynecological and pulmonary affections, changed to 40 and 50 cm. respectively. The irradiated fields were larger than the focus of inflammation.

The dose administered by the author was ordinarily 120 German R; in children and severe pneumonias, half as much.

Where there was no complete recession in five days, a second irradiation was administered under the same conditions. It happened very rarely that a third irradiation was needed after a further interval of five days.

Diathermy in Gynecology. G. Kolischer, M.D.

American Journal of Obstetrics and Gynecology, 19:550 (April) 1930.

The value of medical and surgical diathermy in gynecological diseases is reviewed by Kolischer. Medical diathermy owes its value to its ability to improve the circulation of the part treated. It attracts at the same time the macrophages of the reticuloendothelial system to the affected part. The heat generated in the deeper structures is in itself, therefore, negligible. This likewise holds for Neisserian infections. The author cites specific laboratory experiments as authority for his contention that the lethal point for gonococci is equal or higher than the heat which is able to destroy the tissue cells so treated. Surgical diathermy is held to have a wide field of usefulness in gynecology. The author contends that electrocoagulation is of great value in the treatment of cancer of the cervix, especially when it is followed by radiation therapy.

A Report of 90 Cases of Endocervicitis Treated With a New Type of Actual Cautery. Harold W. Baker and G. Stanley Miles.

Am. J. Obstet. & Gynec., 19:548 (April) 1930.

A report is made of 90 patients treated with the new Baker Cautery, which utilizes a bakelite handle with the switch in such a position as to be easily accessible without changing the position of the hand. The cautery tip is of platinum, 2¼ inches long, and is introduced into the cervical canal while cold. The endocervix is heated gradually, and only a very superficial area (to a depth of one mm.) is actually charred. The heat penetrates deeply enough to destroy the depths of the glands and to cause thrombosis of the blood vessels. The tabulated results show that 36 out of 42 patients cauterized during other operations were cured, or 85.7 percent, and another series of 42 out of 48 or 87.5 percent were cured when cauterized without an anesthetic.

Lichtbehandlung Der Tuberkulose Der Haut. (Light Treatment of Tuberculosis of the Skin). Axel Reyn.

Strahlenther. 34; 13-31. (October), 1929.

The only disadvantage to Finsentherapy lies in its long duration. But apart from this circumstance the results of treatment by concentrated carbon arc light are outstanding in lupus vulgaris, verrucous tuberculosis of the skin and anatomical tubercles. It can be said that almost all cases are cured provided they are correctly treated for a sufficiently long time. Besides cutaneous tuberculosis, the author also treats fistulous ganglia by local light therapy at the Finsen Institute of Copenhagen. In lupus and tuberculosis of the conjunctiva, light-therapy is the method of choice. As preliminary to treatment, excision comes into question in lupus, as also with corrosion by a pyrogallic salve. Such a salve can be employed for from 3 to 5 days, being changed daily. Then an extensive ulceration of all lupus portion arises which heals under an indifferent ointment such as zinc — lanolin — petrolatum. Thus the treatment can no doubt be somewhat shortened in extensive cases. As soon as the cauterized area has cleared up to some extent, one immediately undertakes light treatment, while other places are cauterized. Now and then the author uses tuberculin injections, beginning with .1 mg. old tuberculin and gradually increasing the dose in proportion to the patient's endurance. Reyn most emphatically objects to preliminary treatment by roentgen and radium rays. The author has not yet seen a cure of a lupus area produced by roentgen or radium rays; on the contrary, patients often came under treatment with severe injuries in the form of atrophy and dilatation of the vessels due to that form of treatment. Great difficulty was encountered when Finsen treatment was inaugurated over such areas, even to the production of ulceration and necrosis of the atrophied skin. Reyn further points out that facial lupus usually starts in the region of the nose in the majority of cases; excision is inadvisable and gives bad results, because there almost always coexists a lupus of the nasal mucosa which undeniably entails recurrences. Hence it is always necessary to treat the lupus of the mucous membrane simultaneously. Finally, it must be noted that the author always uses the combined local and universal light treatment in all forms of tuberculosis of the skin.

Ultraviolet Treatment of Ulcus Serpens. H. Gasteiger.

Klinisches Monatsblatt für Augenheilkunde, No. 3, 1929.

In 75 cases U. V. proved successful in 92%, while 20% of the affected eyes were lost in cases that were not irradiated. The ulcer is sensitized to ultraviolet with Fluorescin or Rose bengale and then irradiated with the Birch-Hirschfeld quartz lamp twice daily for five or six minutes.—*Ars. Medici, 8:172 (April) 1930.*

Physical Therapy in Gastro-Intestinal Diseases. Prof. A. Strasser, Vienna.

Mitteilungen des V.-G.-A. No. 12, 1929.

With gastric and duodenal ulcers, hot poultices, as suggested by *Leube,* are often helpful but may only be applied where there is no danger of perforation or haemorrhage. They should be applied as hot as possible and changed every 10 minutes for 10 hours daily. After a few days blisters develop; they are covered with a thick paste of lanolin and the treatment continued. — A hot drink (tea, etc.) after a meal is also very useful. This also accelerates the opening of the pylorus and the evacuation of the stomach chiefly by a reflex passing over the corresponding segment of the spinal cord, as is the case with external application of heat. Genuine hypersecretion such as Reichmanns gastrosuccorrhoea also reacts favorably to heat. — With gastroptosis and atony, the tone of the muscular apparatus of the stomach may be distinctly improved by douching alternately with hot and cold water (care being taken in the event of ulceration!). The evacuation of the full stomach may be promoted by certain grips such as are applied by x-ray specialists for filling the upper segment of the stomach in contrast examination. Excellent results may be achieved in cases of enteroptosis by placing a hot-water bottle or a hot sand-bag over the full stomach with the foot of the bed raised, the weight of the load being increased gradually from 1 to 3 kilos. Mild faradisation certainly improves the tone. — Chronic constipation is usually of a spastic nature. The spasms can be demonstrated along the whole colon; they are incited by a great variety of conditions of irritation (anal fissure, haemorrhoids, proctitis, colitis, disease of the appendix, inflammation of the adnexa, etc.). Antispasmodic therapy, therefore, usually produces more satisfactory results than a stimulating treatment. General hydrotherapy often has a constipating effect, at any rate at the beginning, as stimuli due to cold produce intestinal spasms. Sitz-baths with gradually increasing temperature, on the other hand, often have excellent results. The temperature should be increased from 96° to 104° in the course of 5 minutes and the bath should last from 15 to 20 minutes. The patient should be covered up without previous cooling and remain recumbent for 20 to 30 minutes. By combining this treatment with a diet rich in ballast substances the most obstinate cases may be cured. The effect is probably due chiefly to reflex processes. Similar results may be achieved with diathermy of the abdomen (possibly with an electrode in the rectum). Mild faradisation, treatment with Tonisator apparatus and massage (moderate kneading and stroking »palpation prolongée«) may also have a regulating effect on the bowels whilst any vigorous stimulation only increases the spasms. —*Ars. Medici, 8:105, (March), 1930.*

Hyperidrosis and Dysidrosis — Spinal Diathermy. Leszezynski, R. v. Lwow.

Ars. Medici, 8:77 (February), 1930.

It is generally recognized that the origin of hyperidrosis and dysidrosis has something to do with the vegetative nervous system; but it is still

unknown whether it is the sympathicus or parasympathicus which is involved. The former is of course a clearly defined entity extending from the I thoracic to IV lumbar vertebra. The parasympathicus is anatomically not so simple, it has three distinct points of origin: the mid-brain, the medulla oblongata and the sacral cord, and is thus divided into a cranial, a bulbar and a sacral portion. Unilateral disappearance of perspiration has been repeatedly observed after division of the communicating rami, extirpation of the cervical sympathicus on one side, or after x-ray irradiation of the spinal cord. On this basis the author has treated hyperidrosis and dysidrosis for a year and a half with spinal diathermy. He prefers this harmless method to x-ray irradiation. The active electrode, 6×8 cm. large, comes on the spinal column between C_8 and T_2, the passive 9×14 cm. large on the sternum below the incisura jugularis. Length of application 20 minutes, 500 to 700 MA current, one treatment daily. The results in 32 cases were excellent. The perspiration ceased and the eczema began to heal. Local x-ray irradiation was often necessary in addition to complete the cure of stubborn eczema. Dysidrosis reacted more promptly to the diathermy; relapse did not occur for a long time. In addition Atophan and an antiurate diet were prescribed. Results were less permanent in hyperidrosis, since the vagotonus was difficult to influence. Still the action was considerably better than with atropin therapy alone. — Diathermy of the cervical and thoracic cord produces hyperaemia only in the sympathicus; no parasympathic fibres are present here. But it is still undecided whether hyperidrosis and dysidrosis are due to diminished tonus of the sympathicus or increased tonus of the parasympathetic system.

Carcinoma of the Skin — X-ray Therapy. Prof. G. Stuempke, Hospital II, Hanover.

Strahlentherapie, Vol. 35, No. 1, 1930.

Report of the results achieved in carcinoma of the skin with treatment by x-rays: 64 cases that had been treated in this way in the course of 15 years have been subjected to detailed reexamination; others either failed to appear for an examination or the reports received from them could not be used as a basis for a verdict. Out of 34 patients suffering from carcinoma of the skin, 21 were cured, 9 improved, one had died. Among those who were cured, 12 had only had a single irradiation, the others had received from ⅔ up to 3 full doses in the course of several years spread over the period. Out of 17 cases of fairly deep-reaching carcinoma of the skin, 10 had been cured, 8 of them by a single sitting; 4 improvements, 3 relapses. The cases that offered the greatest difficulty were those of carcinoma developing upon lupus; the results achieved with 13 patients are less favorable, i. e. 10 improvements, 2 relapses, 1 death. In cases of this kind, radium should perhaps be used by preference, especially when thorough x-ray treatment has been given previously.—*Ars. Medici, 8:213 (May) 1930.*

Colonic Therapy in Stubborn Cases of Urticaria. (Enterocleaner Treatment). Prof. G. Scherber, Rudolfsspital, Vienna.

Wiener medizinische Wochenschrift, No. 37, 1929.

Severe recidive cases of urticaria, often lasting months, with tormenting itching in the night, often produce insomnia and may weaken the entire organism. Although constitutional conditions or nervous irritation are frequently of etiological importance, the cause is usually to be found in the gastrointestinal tract. A laxative (Pulvis liquirit. compos. or mineral water is best) followed by enema and strict diet for a few days usually brings on recovery. But in some cases this therapy is fruitless. The author believes that in such cases residues of ingesta, products of decay, or pathological germs lie concealed in the intestinal folds and haustrae from where they distribute toxic products. An excellent method of treatment of such cases is afforded by irrigation of the colon with Brosch's Enterocleaner apparatus, with which the author has promptly cured most cases of chronic urticaria. The apparatus makes it possible to send large quantities of fluid to and fro in the colon up to the coecum without inconvenience to the patient. In this way ingesta and decay are washed out and the pathological intestinal flora is in a large measure eliminated while its culture medium is removed. If the Enterocleaner method does not produce recovery then the etiological agent does not lie in the colon but in the upper intestinal passages, or else constitutional or nervous factors are responsible; the therapy must then be directed against these factors: a general unspecific desensibilisation with peptone (0.5 gm. per os an hour before meals), autogenous serum or blood injections may be used. —*Ars. Medici, 8:167 (April) 1930.*

Fresh Wounds — X-ray Treatment. Prof. L. Freund, Vienna.

Deutsche Zeitschrift für Chirurgie, Vol. 222, No. 6, 1930.

Some time ago, the author recommended the method of leaving the operation wound from excision of a keloid unsutured and treating it by small x-ray doses. As good results have been achieved with this method, the writer, in collaboration with H. Salzer (Vienna), has used it for the treatment of lupus vulgaris, rodent ulcer, epithelioma and naevus pigmentosus also, affections treated partly surgically and partly by radiotherapy; in suitable cases equally satisfactory results have been achieved as with keloids. Excision wounds that had been closed by suture, on the other hand, when given after-treatment with x-rays often developed thick, hard oedematous scars which are favorable to the prolific growth of excitant agents of the disease which may have been left behind. This need not be anticipated if the open wound is exposed to the rays. The resulting scar is irreproachable from the cosmetic point of view, soft, smooth and delicate. Even fairly extensive foci

heal in this way in the course of from 6 to 8 weeks, so that the method has the further advantage that it saves time. Parts where the skin is stretched over solid underlying tissues are most suitable for this treatment, whilst parts forming receding angles, such as the upper end of the naso-labial fold or near the ala nasi or behind the lobe of the ear, are unsuitable. In such parts, recesses or cavities remain after the excision, the inner surface of which cannot be reached by the rays in its entire extent. Excessively large foci are less suitable for this method of treatment which has otherwise proved so successful. Technique: 6 or 7 sittings of 50 R each at intervals of 2 or 3 days, altogether about 300—350 R, i. e. rather more than the dose used for epilation. Unfiltered rays of No. 6 to 7 Wehnelt are evidently more suitable than well-filtered harder rays.—*Ars. Medici, 8:215-216 (May) 1930.*

Light Treatment of Tuberculosis of the Eyes. Wolfgang Hoffman, M.D., Chief Medical Officer, Ophthalmic Clinic, Konigsberg University, Prussia. (Director, Professor A. Birch-Hirschfeld).

British J. Actinotherapy, **4:***182, December, 1929.*

From experience obtained in our clinic during a period of about ten years, we have gained the impression that, in tuberculous diseases of the eyes, the general light bath has mostly a favorable effect —though, it is true, only when applied in conjunction with other methods.

Compared with general treatment, local treatment of tuberculous eye diseases is far more favorable.

Up to the present it has not been proved experimentally that ultraviolet light may cause cataract. From our extensive material (far over 1,000 cases), and over an observation period of more than 10 years, we can add that we have not seen a case of cataract appearing after therapeutic irradiation, although we have frequently had the opportunity of re-examining the patients.

We must exclude infra-red and visible light from the radiations used for therapeutic purposes, until we can avoid any unintentional action by these rays on the healthy part of the eye. On the other hand, the short-wave ultraviolet rays should be present as strongly as possible when irradiating the cornea or conjunctiva. But in diseases of the iris it would be wrong to use rays under 3,000 A. U. for therapeutic purposes, or to leave such a considerable quantity in the radiation that it would not reach the iris, but would remain in the cornea.

In accordance with these considerations, eye irradiation lamps consist of a focal source of light (carbon arc or mercury vapor), a condenser lens, a light filter (usually of blue uviol glass), then a cooling filter of copper sulphate solution to cut out the infra-red radiations. The Kromayer lamp, with suitable adaptors, can also be used. As its visible light is weak, its radiations may in many cases be used unfiltered.

We have tried to define biologically the dose most frequently employed in our clinic, so as to have at any rate some data to go on. This is the amount of rays which in conjunctiva tarsi of rabbits, causes marked dilatation of the vessels after 12 hours, moderate oedema and superficial necrosis. We call this briefly, "a conjunctival dose," and base the subsequent irradiation on it. Before a lamp is used, the time for this dose is fixed, and patients are dosed according to this time.

Among tuberculous diseases of the eye, to which local light treatment can be applied, mention must in the first place be made of diseases of the conjunctiva because in these the advantage of light treatment over other methods was first distinctly shown.

Light treatment carried out correctly, contains no such dangers to the eyeball as are present with radium treatment while it holds out equally favorable prospects of cure.

A disease which can be certainly removed by light treatment is episcleritis, or scleritis.

The technique is the same for both the foregoing diseases. The nodules are irradiated sufficiently to cause central or superficial necrosis with a wide hyperaemic areola, using the previously-mentioned "conjunctival dose." Under some circumstances, according to the thickness of the tubercle, one and one-half to two times the quantity may be given. After reaction has subsided (i. e., three or four days), irradiation is repeated as required. The irradiated place then appears to be flatter, frequently even sunken.

In order to recognize the tubercles in the conjunctiva more easily, and to be more certain that the rays reach them, we use a simple expedient. In U. V. light the nodules have a grey-green fluorescence; in the blue light of the irradiation lamp they are, however, difficult to recognize. Therefore, we use spectacles of dark green glass (Hallauer, No. 66), which absorbs the light of the lamp, but the fluorescent light from the tubercles comes through. Thus it is possible to see exactly where the point of light must be directed.

Carcinoma of the Cervix Complicating Pregnancy. X-ray Therapy With the Birth of a Normal Child. Ira A. Kaplan, M.D.

American Journal of Obstetrics and Gynecology, 19:654 (May) 1930.

Eight cases are reported of plexiform carcinoma of the cervix, treated by x-ray at the third month of pregnancy. The treatments were incomplete due to lack of cooperation of the patient.

At term she delivered a baby entirely normal which, nevertheless, died from birth complications. The patient bled considerably but transfusion and local irradiation treatments tided her over. Six months later she resumed her housework with the local lesion of the cervix completely healed.

Incontinence of Urine in Women. E. Picard, Berlin.

Zentralblatt für Gynaekologie, No. 49, 1929.

This trouble is very frequent; about 10% of the women who suffer from gynaecological diseases show the symptoms of incontinence though usually only partial. Among the large number of operative methods of treatment that have been suggested, only direct plastic operation on the muscle (gathering in of the posterior third of the urethra and of the floor of the bladder) and plastic operation on the fascia and the pyramidalis muscle have proved of value. For the large number of women who shun operation, the writer recently, at the 9th meeting of the German Association of Urologists, recommended intravesical electrocoagulation which has been known since 1924 but is still used very little. This method is not suitable for complete but only for relative incontinence. If cystoscopy shows the sphincter to be only so far deformed that its lower edge is still horizontal, all that is necessary is to make three eschars on each side and above it in several sittings. If the descensus has reached such a degree that the lower edge of the sphincter is convex, that region of the uvula vesicae should be scarified in several sittings. Slight haematuria, which sometimes occurs, soon disappears spontaneously and the lower scar develops into a kind of arched uvula. The writer has treated 19 women by this method all of whom regained complete control. He suggests that in every case of relative incontinence, electrocoagulation should be tried first of all which will, in the majority of cases produce a tight closure and forms no obstacle to operation should it nevertheless become necessary. — *Ars. Medici, 8:165 (April) 1930.*

Acute Epididymitis and Weakness of Potency — Diathermy of the Testicle and Epididymis. J. Kowarschik, Vienna.

Zeitschrift für Urologie, Vol. 24, No. 5, 1930.

In acute epididymitis, diathermy of the testicle and epididymis has a very favorable effect on the painfulness and swelling; these symptoms abate quickly and the duration of the cure is considerably shortened. Diathermy may be applied as early as on the fourth or fifth day of the disease without any danger of the inflammation spreading to the testicle or the vas deferens. — Another indication for this therapy is the weakness of potency associated with deficient production of hormones; the impotence originating in psychic factors is also effectually helped by diathermy of the testicles. — Technique: the author uses an electrode designed by himself (obtainable from Schulmeister, Vienna, IX., Spitalgasse 5) consisting of plated »alpaca« net, 14 by 14 cm. The net is composed of two layers which are joined at the edges. At one corner there is a small metal plate for attaching the clamp of the electric wire. A lead plate, 200 to 300 cm. sq. is placed under the buttocks as the inactive pole. The scrotum is then raised, a cloth folded to a hand's breadth placed under it and the scrotum isolated by a piece of rubber sheeting in the form of an apron. The net is dipped into warm water and spread over the scrotum where it keeps in place of its own accord without needing to be fixed. Care should however be taken that the edges and corners rest on the rubber in order to avoid burns. Neither must the electrode be allowed to slip off owing to an accidental pull on the wire; for this purpose a sandbag is placed over the wire that passes over the thigh — on no account on the scrotum. The strength of the current should be 0.6 to 1.0 ampère, with more severe swelling of the scrotum even a little more. This method is simple, convenient and rapidly successful and is therefore recommended for trial. It is important to have the electrode boiled after every treatment.

Intensive Quarzlichtbehandlung Der Ischialgie. (Intensive quartz mercury lamp treatment of ischalgia). R. F. Weiss.

Medizinische Klinik 1929, Ann. 25, Nr. 15, (April), p. 584-585.

Frequently very good results may be obtained by the uni- or bilateral irradiation of the whole region of the sciatic nerve with the erythema dose at short intervals. However, the patient's attention is to be called to the fact that an intense dermatitis will ensue and ought to do so, but that it is always harmless, causing, it is true, burning and itching for some days, but passing off quickly. Powders and ointments applied between irradiations will suffice to produce subjective relief. It is essential to the therapeutic effect that a dermatitis really appear; a simple pigmentation of the skin would not do. *Technique of irradiation:* the whole region of the sciatic nerve is divided into 4 areas. A superior border is plotted out to extend in front and back from the inferior and posterior border of the thorax to the region of the buttocks inclusively, and an inferior one from the gluteal sulcus to the calf. For 4 or 6 successive days, respectively, each field is irradiated with an erythema dose at a focal distance of from 60-80 cm., with careful protection of the surrounding tissue; the time of exposure, 10-20 minutes, depends upon the burner. First the fields of one side, then those of the other side are irradiated. The same course of treatment can be repeated after 4-6 weeks, eventually even more frequently if necessary.

Ulcus Cruris. (Varicose ulcer of the leg). Herbert Fuhs.

Wiener klinische Wochenschrift 1928, Ann. 41, Dec., p. 1653-1657.

In cases of indolent ulcers with slight tendency to granulation and epithelialisation, satisfactory therapeutic results may now and then be obtained by weak irradiation with the alpine lamp, together with diathermy and fulguration. These combined measures improve the circulation and nutrition of the adjacent tissue. On the contrary, a stimulating effect from small and minimal doses of x-rays, on granulation and epithelialisation could be ascertained in very few cases.

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